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## A systematic review to identify and assess the effectiveness of alternatives for people over the age of 65 who are at risk of potentially avoidable hospital admission.

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people over the age of 65 who are at risk of potentially avoidable hospital admission.

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## ABSTRACT

## **Background / objectives**

There are some older patients who are 'at the decision margin' of admission. This systematic review sought to explore this issue with the following objective: What admission alternatives are there for older patients and are they safe, effective and cost-effective? A secondary objective was to identify the characteristics of those older patients for whom the decision to admit to hospital may be unclear.

## Design

Systematic review of controlled studies (April 2005-December 2016). The protocol is registered at PROSPERO (CRD42015020371). Studies were assessed using the Cochrane risk of bias criteria, and relevant reviews were assessed with the AMSTAR tool. The results are presented narratively and discussed.

## Setting

Primary and secondary health care interface.

## **Participants**

People aged over 65 years at risk of an unplanned admission.

## Interventions

Any community-based intervention offered as an alternative to admission to an acute hospital

## Primary and secondary outcomes measures

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Reduction in secondary care use, patient-related outcomes, safety and costs.

## Results

Nineteen studies and 7 systematic reviews were identified. These recruited patients with both specific conditions and mixed chronic and acute conditions. The interventions involved paramedic/emergency care practitioners (n=3), emergency department-based interventions (n=3), community hospitals (n=2), and hospital-athome services (n=11). Data suggest that alternatives to admission appear safe with potential to reduce secondary care use and length of time receiving care. There is a lack of patient-related outcomes and cost data. The important features of older patients for whom the decision to admit is uncertain are: age over 75 years, co/multimorbidities, dementia, home situation, social support and individual coping abilities.

## Conclusions

This systematic review describes and assesses evidence on alternatives to acute care for older patients and shows that many of the options available are safe and appear to reduce resource use. However, cost analyses and patient preference data is lacking.

## STRENGTHS AND LIMITATIONS OF THIS REVIEW

- 1. High quality systematic review of controlled studies.
- 2. Specific focus on admission avoidance interventions for acute care of older people.
- 3. Studies cover a wide range of acute conditions and acute exacerbation of chronic conditions in older people.
- 4. Some of the studies are pragmatic in approach and are at high risk of bias.
- 5. Most studies do not provide associated costs/cost analyses of interventions or patient preference data.

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## Introduction

Reducing emergency bed days is one of the biggest challenges currently facing the National Health Service (NHS) in the United Kingdom. There is considerable pressure to reduce hospital admissions amongst older people.<sup>1</sup> It has been suggested that clinicians should: 'choose to admit only those frail older people who have evidence of underlying life-threatening illness or need for surgery'.<sup>2</sup> There has been a 65% increase in hospital admissions for those over 75 years of age in the last decade. Furthermore, people over 85 years of age now account for 11% of emergency admissions and 25% of critical care bed days.<sup>3</sup> Decisions to admit to an acute hospital are often influenced by inadequate knowledge of the patient or condition, communication difficulties between primary and secondary care, perceived benefits of in-patient care and patient preferences.<sup>4</sup> A review of urgent and emergency care by NHS England highlighted the need to identify those frail and elderly people who need care but do not have a medical need requiring hospital admission.<sup>3</sup> It is clear that there are some older patients for whom care in the community is safe, perhaps with the provision of additional services, and some for whom admission is required in order to deliver diagnostics or treatment that are only available in hospital. However, for those patients 'at the decision margin', the best path of action may be unclear.<sup>5</sup> The decision may be affected by non-clinical and clinical factors e.g. multi-morbidity, support at home or how much risk the patient or family are willing to accept.

Our specific objective was to conduct a systematic review to identify studies of community-based interventions aimed at reducing secondary care use in older patients with acute medical problems potentially requiring unscheduled hospital

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admission. A secondary objective was to further confirm the characteristics of those older patients for whom the decision to admit to hospital may be unclear.

## Methods

## Protocol and registration

The protocol for the systematic review was registered at the PROSPERO register on 14/06/2015. Registration number is: CRD42015020371 (Supplementary material)

## Eligibility criteria

Publications of any randomised controlled trial (RCT) or controlled observational study (COS) that described people aged over 65 years, of either sex living in Organisation for Economic Co-operation and Development countries being considered for an unplanned admission were eligible for inclusion. The control was acute hospital admission. The studies had to include at least one of the following as either a primary or secondary outcome: intervention effectiveness, patient related outcomes, safety outcomes or healthcare costs, otherwise they were excluded.

## Information sources and searches

Medline, Medline In-Process, Embase, Cinahl and CENTRAL databases were searched from January 2005 to April 2015 inclusive using search terms based on the eligibility criteria. (Appendix 1) An update was run in December 2016 across Medline and Medline In-Process. We included any relevant systematic reviews published between 2010 and 2016. The decision to time limit the searches was based on the fact that the systematic reviews would cover any older studies and that any evidence not included in these two sources was unlikely to be relevant to the fast changing primary and secondary health care interface. The King's Fund and

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Agency for Healthcare Research and Quality websites were also searched in April 2015.<sup>6,7</sup> The resulting references were managed using EndNote X6 software. All references were screened by title and abstract followed by full text, both independently and in duplicate (AH, BD), using predefined inclusion/exclusion criteria. Any disagreements in either stage were resolved using a third reviewer (SP). The reference lists of included studies were checked and forward referencing was conducted using Google Scholar. Authors of included studies were contacted for details of any extra studies.

## Data items and collection process

Data from all primary studies (2005-2016) were extracted into a custom-designed table. The main results and conclusions of recent high quality systematic reviews (2010-2016) which included relevant primary studies were also recorded.

## Assessment of risk of bias of individual studies (Appendix 2)

The Effective Practice and Organisation of Care Cochrane risk of bias tool was used to critically appraise RCT or COS publications.<sup>8</sup>

## Assessment of methodological quality of systematic reviews (AMSTAR)

## (Appendix 3)

The AMSTAR checklist was used to assess the quality of the included systematic reviews.<sup>9</sup>

## Synthesis of results

The data are presented narratively describing, if present, the most relevant systematic review and individual studies for each intervention and, where appropriate, for a specific condition.

In order to identify the characteristics of those older patients for whom the decision to admit to hospital may be unclear, the inclusion/exclusion criteria and demographics of the various studies' participants were examined and key features were tabulated alongside the number and references of relevant studies.

#### Results

The systematic review identified four types of intervention from across 19 studies published in 24 individual papers: paramedic/emergency care practitioners (n=3), emergency department (ED) interventions (n=3), community hospitals (n=2), hospital-at-home services (n=11).<sup>10-33</sup> [Figure one](Appendix 4) Fifteen of the studies were conducted in western European countries of which four were in the UK. Two studies were conducted in Australia and two studies in the United States (US). Risk of bias, general intervention description, AMSTAR and study data are detailed in Appendices 2-5.

## Paramedic practitioner/emergency care practitioner (PP/ECP) interventions

Three studies were identified.<sup>10-12</sup> A cluster RCT (Mason 2007), compared PPs with additional training (n=1469) with standard PPs (n=1549) in assessing and treating elderly people following 999 calls with the aim of measuring subsequent emergency care.<sup>10</sup> Similarly, two more recent COS investigated the role of ECPs in avoiding ED) attendance/admissions in elderly populations.<sup>11, 12</sup> Gray 2008 was a case-series

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study of ECP attendances for elderly patients aged over 65 years with a fall (n=233) compared with historical controls (n=772), and Mason 2012 was a cluster controlled study of enhanced ECP care for five care homes (n=256) compared with standard care in five other care homes (n=201). Risk of bias was low for all the domains of the cluster RCT and both of the COS were at high risk due to lack of randomisation. In the cluster RCT, all primary outcomes comparing the intervention with the control group were improved: relative risk of ED attendance within 28 days (RR 0.72 (0.68, 0.75)), relative risk of hospital admission within 28 days (RR 0.87 (0.81, 0.94)), being very satisfied with care (RR 1.16 (1.09, 1.23)) and mean total episode duration in hours (-42.2 (-59.5, -25.0)) with a reported p<0.001 for all.<sup>10</sup> The secondary outcome of mortality was comparable between groups, but intervention patients had a greater number of subsequent unplanned contacts with secondary care at 28 days (330 vs. 259 p<0.01).

The two COS reported a greater reduction in admissions when comparing the intervention with normal ECP practice but these results are of limited use due to the high risk of bias of the studies.<sup>11, 12</sup>

None of the studies of PP/ECP interventions provided details of cost data or costeffectiveness analysis.

## Emergency department (ED) interventions

The searches identified one RCT (Sun 2014) which was assessed to be at low risk of bias, and two COS (Benaiges 2014, Salvi 2008) in which the risk of bias was high for several domains including randomisation.<sup>13-15</sup>

Sun and colleagues conducted a RCT in which patients attending ED with syncope were randomised to receive either a syncope protocol in an observation unit (n=62) or usual care (n=62).<sup>13</sup> where the maximum stay in the observation unit could not exceed than 24 hours.

In terms of primary outcomes, patients randomised to the intervention spent less time in hospital at the index visit (29 vs. 47 hours p<0.001) and were less likely to be admitted to hospital (RR 0.16 (95% CI 0.09, 0.29) p<0.001). There were no differences in the secondary outcomes of serious events, quality of life (QoL) or satisfaction with care between groups. A reduction in costs was reported but no formal statistical comparison was performed (index visit US\$1400 vs. 2420, 30 days US\$1800 vs.2520 (2011 data)).

The first of the two COS compared usual care with treatment in a 'day hospital' for hyperglycaemic crisis from which the main result was improved readmission rates and associated costs (Benaiges 2014), whilst the second COS compared a specialist geriatric ED intervention with a standard ED procedure (Salvi 2008) but without evidence of any differences in outcome and had significant differences in baseline demographic data. <sup>14,15</sup>

### Community hospital (CH) interventions

Two RCTs were identified describing a community hospital (CH) intervention as an alternative to acute hospital (AH) care.<sup>16-19</sup> Both RCTs were at low risk of bias overall. In the RCT by Vicente, participants were randomised following triage at home to either go to a CH (n=410) or to the ED (n=396).<sup>16</sup> The data presented were limited. The authors reported that the nurse attending the patient at home sent 90

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intervention participants to the CH (primary outcome) although six of those individuals were subsequently transferred from the CH to the ED (secondary outcome). There were no formal statistical analyses nor were cost data presented.

The Garåsen RCT compared CH care (n=72) to AH care (n=72) and was published over three separate papers. <sup>17-19</sup> There was no distinction between primary and secondary outcomes. At 26 weeks, there were fewer readmissions in the CH group versus the AH group (19% vs. 36%, p=0.02) and more people receiving no care (25% vs. 10%, p=0.01). At 12 months, there were fewer deaths in the CH group (18% vs. 31%, p=0.03) although the observation period was considerably longer in the CH group (335.7 vs. 292.8 days, p=0.01). Total cost of treatment was less in the CH group compared with those receiving AH care NOK 39,650 ((95% CI kr 30 996-48,304) versus NOK 73,417 (95% CI NOK 52 992-93,843)) data collected 2003-2005 (p = 0.002). Average health services costs per patient/day for the entire observation period was NOK 606 (95% CI £ 450- 761) in the CH group compared to NOK 802 (95% CI NOK 641-962) in the AH group (p = 0.026).

## Hospital-at-Home (HaH) interventions

Eight of the HaH studies were focused on specific conditions: heart failure (n=3), chronic obstructive pulmonary disease (n=1), pulmonary embolism (n=1), pneumonia (n=1), stroke (n=1), and uncomplicated diverticulitis (n=1). <sup>20-28</sup> The remaining three HaH studies recruited older participants with a range of conditions, and two of these recruited from residential homes and were not included in recent high quality systematic reviews.<sup>29-33</sup> All the specific condition studies were included in recent (2010-2016) systematic reviews.<sup>34-40</sup>

## Heart failure (HF)

Three RCTs were identified on HaH for HF and their results published in four separate papers.<sup>20-23</sup> These studies were included in two previous reviews of HaH one which focused on HF (Quaddoura 2015).<sup>34,35</sup> This review used the Cochrane risk of bias tool and described the overall quality of the RCTs as modest. The AMSTAR rating of the review highlighted a lack of description of excluded studies and the combination of different QoL measures in meta-analysis.

The patients were randomised to either HaH or AH within the ED and the primary outcomes of the review were hospital readmissions and mortality. HaH increased time to first readmission (mean difference (MD) 14.13 days [95% Cl 10.36, 17.91] p=0.015 using data from two RCTs (n=132).<sup>22-23</sup> although there was no strong evidence of an effect on the rate of readmission (RR 0.68 [0.42, 1.09]) using data from two RCTs (n=172).<sup>20,22</sup> This is a sizeable reduction, but consistent with chance in a data set of this size. An improvement was reported in health-related QoL at both 6 and 12 months (standardized MD (SMD) -0.31 [-0.45 to -0.18]; SMD -0.17 [-0.31 to -0.02] respectively). HaH was comparable to AH care on all-cause mortality (RR 0.94 (0.67, 1.32)) using data from all three RCTs. These studies also showed a significant reduction in costs for the index treatment period (p<0.001). Two trials<sup>20,23</sup> reported lower costs in the HaH group at 12 months, although the difference was not statistically significant in one of the studies.<sup>20</sup> When the authors of this particular review calculated total costs for these two trials, both indicated a cost reduction for HaH compared to AH care.

### Chronic obstructive pulmonary disease (COPD)

An RCT by Ricauda was published in 2008 and was also included in two recent systematic reviews - one focusing on COPD and one more generally on HaH.<sup>24,35,36</sup>

to our 2005 inclusion date.

comparable between groups (20.2%).

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The high quality COPD review included eight RCTs, one of which described HaH in

an early discharge setting, plus the Ricauda trial and six which were published prior

The Ricauda RCT compared HaH (n=52) with AH (n=52) and was conducted with

low risk of bias. The primary outcomes were hospital readmission and mortality

The study showed that there were fewer hospital readmissions for HaH patients

compared to AH patients at 6 months (42% vs 87%, p=0.001) although HaH patients

had a longer length of stay than those in the AH group (15.5 SD±9.5 vs 11.0 ±SD 7.9

days, p=0.01). Whilst HaH patients experienced improvements in depression and

QoL scores during the study, there was no evidence of difference between the two

All patients discharged from HaH completed the care programme at home, whereas

discharge, with an average daily cost of 174.7 for a mean period of 25 ±8.7 days.

Overall - on a cost per patient per day basis - HaH care was less expensive than that

given to the AH group ( $101.4 \pm 61.3$  vs  $151.7 \pm 96.4$ , p=0.002). This RCT reflected

groups for these outcomes at 6 months. Cumulative mortality at 6 months was

11.5% of AH patients continued their care in a long-term facility after hospital

the results of the previously published systematic review.<sup>36</sup>

rates at 6 months. The secondary outcomes included a range of depression,

functional, cognitive and nutritional measures as well as costs.

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## Pulmonary embolism

Our review identified one published COS of HaH (Rodriguez-Cerillo 2009) for patients with pulmonary embolism which was also included in a recent systematic

review with seven other observational studies (Vinson 2012).<sup>25,37</sup> The high quality review concluded that the overall incidence of mortality at 90 days was very low.

The COS compared HaH (n=30) with AH (n=31) and was at high risk of bias overall.<sup>25</sup> No distinctions between primary and secondary outcomes were made. Mean length of stay was not statistically different comparing HaH with the AH group (8.9 days (7–14 days) vs. 10.6 days (6–20 days)). No patients treated at home required unexpected return to hospital during admission. There was no major bleeding, thrombosis or death in either group at 90 days in the COS.<sup>25</sup> There were no cost data reported.

#### Pneumonia

Our review identified one RCT (Carratala 2005) published and included in a recent systematic review (Chalmers 2011) which also described a further five studies comprising a variety of designs).<sup>26,38</sup> The RCT compared HAH (n=110) with AH (n=114) and was at low risk of bias. The primary outcome was the percentage of patients with an 'overall successful outcome' according to seven predefined criteria <sup>26</sup> whilst secondary outcomes were patients' QoL and satisfaction. An overall successful outcome was achieved in 83.6% of HaH patients and 80.7% of AH patients (absolute difference 2.9% [95% CI, 7.1-12.9]). Subsequent hospital admissions were comparable between groups (6.3 vs. 7.0%). More HaH patients were satisfied with their overall care (91.2 vs. 79.1%; ab 12.1% [CI, 1.8 to 22.5%]). Reported QoL scores were comparable between groups as was the percentage of patients with adverse drug reactions (9.1 vs. 9.6%), medical complications (0.9 vs. 2.6%), and overall mortality (0.9 vs. 0%) for HAH and AH patient groups

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respectively. There were no cost data presented. This RCT data reflects the result of the systematic review by Chalmers 2011.<sup>38</sup>

#### Stroke

One RCT on HaH for stroke patients (Kalra 2005) was published and also included in two previous systematic reviews.<sup>27,35,39</sup> This RCT was at low risk of bias. The primary outcome measure was death or institutionalisation at one year. This threearm study randomised patients into care on a stroke unit (SU) (n=152), care in a general ward (GW) with stroke expert advice (n=152) and HaH with stroke expert advice (n=153) within 72 hours after recruitment in the ED department. Mortality and institutionalisation at one year were lower in the SU group compared with either the GW (14 vs. 30%, p < 0.001) or HaH groups (14 vs. 24%, p=0.03). Significantly fewer patients cared for on the SU died compared with those in the GW group (9 vs. 23%, p = 0.001). The SU group showed greater improvement on basic activities of daily living compared with the other two groups (change in Barthel Index 10 vs. 7, p < 0.002). QoL at three months was significantly better in SU and HaH patients. There was greater dissatisfaction with care in the GW group compared with SU or HaH groups. The total costs of stroke care per patient over 12 months (data collected 2005-2008) were £11,450 for the SU group, £9527 for GW group and £6840 for HaH group.

### Uncomplicated diverticulitis

Our systematic review found one COS (Rodriguez-Cerrillo 2013).<sup>28</sup> This study was also included in a recent, moderate quality integrative review on admission-avoidance HaH services.<sup>40</sup> This COS compared HaH (n=34) with AH (n=18) for patients with uncomplicated diverticulitis and was, overall, at high risk of bias with no

defined primary or secondary outcomes were defined. No statistical detail was provided about any of the data presented. None of the patients treated at home were transferred to the acute hospital. The mean length of stay in the intervention group was 9 days, compared with 10 days in AH. HaH treatment was associated with a cost reduction of €1368 per patient.

#### Older population with acute medical problems

One COS recruited acutely ill older persons and was published across three separate papers (Leff 2005, main publication).<sup>29-31</sup> This COS compared HaH (n=169) with AH (n=286) with the majority of patients being identified the morning after admission. The study was at high risk of bias.<sup>29</sup> There was no distinction made between primary and secondary outcomes. Patients treated with HaH had a shorter length of stay compared with those given AH care (3.2 vs. 4.9 days, p =0.004). The mean treatment cost was lower for HaH care than for acute hospital care (\$5081 vs. \$7480, p< 0.001). Eight weeks after admission, there were no differences in the use of health services between HaH and AH patients in terms of ED visits, (0.23 (SD 0.66) 0.22 (SD 0.57)) or readmission (0.28 (SD 0.59) 0.27 (SD 0.55)).

The COS by Crilly 2010 recruited elderly nursing home patients presenting at ED but who were willing to receive care back in their nursing home (n=62) and compared these with historical control care home patients who had been hospitalised (n=115). The study was at high risk of bias <sup>32</sup> and no primary outcomes were specified. Intervention participants experienced a longer time in ED than those who had been admitted into hospital (9.94 vs. 7.01 hours p=0.005) but required less time being subsequently cared for (2.19 vs. 6.2 days p<0.001). Overall, the length of an episode of care in days (9.56 (1.26) vs. 6.20 (0.59) days, p=0.14) and the number of

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readmissions within 28 days (11.3 vs. 11.3, p=0.99) were not statistically different between the two groups. There were no mortality or cost data presented.

The COS by Lau 2013 assessed residents of a care home presenting at ED who were subsequently treated back in their care home (n=95) and compared data with historical hospital controls (not from care homes) (n=167).<sup>33</sup> No primary outcomes were specified and the study was at high risk of bias. Length of stay was significantly shorter for those in the intervention group compared with the controls (2.0 vs. 11.0 days p<0.001) although mortality (11 (11.6%) vs. 20 (12.0%), p=0.924) and readmission rates (39 (41.1%) vs. 68 (40.7%), p=0.963) at 6 months were comparable between groups. There were no cost data presented.

# Characteristics of those older patients for whom the decision to admit to hospital may be unclear (Appendix 6)

Fifteen of the studies included in our systematic review recruited a population with a mean age of more than 75 years, despite the inclusion criterion specifying those over 65 years. Whilst 9/19 studies specifically stated their recruited population was multi-morbid, it is plausible that all the study populations were and so this is very likely to be a factor which impacts on decision-making in acute medical care. Eight studies specified a particular degree of severity for dementia as an inclusion criterion but, in practice, this is a difficult assessment to make in the acute care context. There were inclusion/exclusion criteria in nine of the studies which specified the importance taking account of an individual's home situation, social support networks and coping abilities as part of the decision-making process.

## Discussion

The findings of our systematic review show that alternatives to acute hospital care at the point of potential admission for people aged over 65 years can be safe, with comparable mortality and clinical outcomes across a range of acute and chronic conditions. They also have the potential to reduce healthcare spending. The key features of older patients for whom the decision to admit may be uncertain are age more than 75 years, co/multi-morbidities, dementia, home situation, social support and individual coping abilities.

Our systematic review was conducted to high methodological standards.<sup>41</sup> The majority of evidence presented is based on HaH services, although this includes treatment of a wide range of conditions. Whilst not all the included studies were randomised or considered to be at low risk of bias, these issues are clearly highlighted and the included studies cover a variety of alternative approaches to hospital admission. The majority of the included studies offer little or no cost data which makes it difficult to assess the cost-effectiveness of any these alternatives to acute hospital care.

As part of our systematic review, any relevant systematic review published in 2010-2016 was included and referred to when discussing the more recent studies. All of these reviews were on the topic of HaH interventions. In addition to being older evidence, some of the previous reviews in contrast to our own included a number of uncontrolled observational studies. Some also included studies in which HaH interventions were applied in the non-emergency or post-discharge settings. By contrast, our systematic review focuses on bringing together controlled studies on

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alternatives to acute hospitalisation at the point of potential admission for the over 65s. The exception to the evidence of benefit of HaH is the treatment of stroke patients, who fare much worse with HaH intervention compared to treatment in a stroke unit. The authors of this study suggest that these differences are due to the overall expertise available in the stroke unit as opposed to care given by generic hospital or homecare staff advised by specialised stroke health professionals. It is recommended therefore that in most cases, in line with current NHS practice for stroke, care should to be provided in specialist units.<sup>42</sup>

In terms of health professionals, making a decision to admit an older patient can be difficult. Decision-making for different of patients draws upon a range of professional experience and expertise and should also be influenced by broader factors such as living conditions and individual/family/carer coping in addition to care preferences. If alternatives to acute admission are available, health professionals have to be confident about these alternative pathways for their patients.<sup>5</sup> Whilst many of the interventions in this review may provide viable alternatives to acute care, they may not exist in some healthcare communities or geographical regions. Furthermore, commissioners of health and social care services require comprehensive evidence of both effectiveness and cost effectiveness of any hospital alternatives as well as adequate resources in order to commission them.

Although our systematic review offered new evidence on several aspects of acute care provision for older patients, there are still many issues to take forward into future research. These include consideration of the wide range of interventions to be delivered, the variety of conditions to be treated, the generation of data to allow cost-comparisons with acute hospital admission, patient and family/carer acceptability,

health professional acceptability, and the commissioning and resourcing of new services.

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## **Competing interests**

None of the authors have any competing interests to declare

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## Authors' contribution

**ALH** Lead systematic reviewer conducting all stages of the review and was responsible for the initial draft of paper.

**MC** Protocol of systematic review is based on outline from NIHR Programme Development Grant in which MC had a significant role. Specific expertise in Patient and Public Involvement. Contributing to discussion as the review progressed. Commenting and editing on the drafts of the paper.

**AH** Specific expertise in patient-related outcomes. Contributing to discussion as the review progressed. Commenting and editing on the drafts of the paper.

WH Specific expertise in health economics. Contributing to discussion as the review progressed. Commenting and editing on the drafts of the paper.

**CM** Specific expertise in trial design and statistical analysis. Contributing to discussion as the review progressed. Commenting and editing on the drafts of the paper.

JB Professor of Emergency Care. Contributing to discussion as the review progressed. Commenting and editing on the drafts of the paper.

**SP** Principal Investigator. Professor of Primary Health Care. Third reviewer of data. Commenting and editing on the drafts of the paper

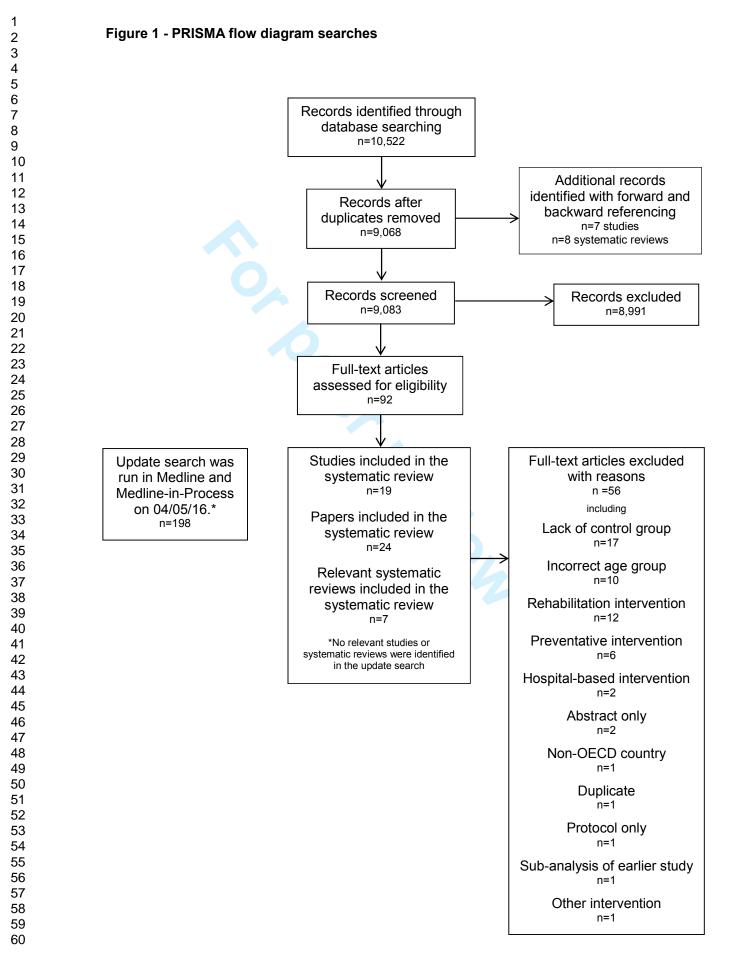
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## Appendix 1: Parent search strategy run in Medline

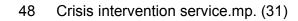
Database: Medline In-process - current week, Medline 1950 to present

Search Strategy: Run April 24<sup>th</sup> 2015

- 1 intervention?ti. or (intervention? adj6 (clinician? or collaborat\$ or community or complex or DESIGN\$ or doctor? or educational or family doctor? or family physician? or family practitioner? or financial or GP or general practice? or hospital? or impact? or improv\$ or individuali?e? or individuali?ing or interdisciplin\$ or multicomponent or multi-component or multidisciplin\$ or multi-disciplin\$ or multifacet\$ or multi-facet\$ or multimodal\$ or multi-modal\$ or personali?e? or personali?ing or pharmacies or pharmacist? or pharmacy or physician? or provider? or regulatory or regulatory or tailor\$ or target\$ or team\$ or usual care)).ab. (178760)
- 2 (pre-intervention? or preintervention? or "pre intervention?" or post-intervention? or post-intervention?").ti,ab. (11719)
- 3 (hospital\$ or patient?).hw. and (study or studies or care or health\$ or practitioner? or provider? or physician? or nurse? or nursing or doctor?).ti,hw. (747131)
- 4 demonstration project?.ti,ab. (2027)
- 5 (pre-post or "pre test\$" or pretest\$ or posttest\$ or "post test\$" or (pre adj5 post)).ti,ab. (72037)
- 6 (pre-workshop or post-workshop or (before adj3 workshop) or (after adj3 workshop)).ti,ab. (653)
- 7 trial.ti. or ((study adj3 aim?) or "our study").ab. (697929)
- 8 (before adj10 (after or during)).ti,ab. (375455)
- 9 ("quasi-experiment\$" or quasiexperiment\$ or "quasi random\$" or quasirandom\$ or "quasi control\$" or quasicontrol\$ or ((quasi\$ or experimental) adj3 (method\$ or study or trial or design\$))).ti,ab,hw. (107858)
- 10 ("time series" adj2 interrupt\$).ti,ab,hw. (1212)
- 11 (time points adj3 (over or multiple or three or four or five or six or seven or eight or nine or ten or eleven or twelve or month\$ or hour? or day? or "more than")).ab. (10245)
- 12 pilot.ti. (43282)
- 13 Pilot projects/ (86631)
- 14 (clinical trial or controlled clinical trial or multicenter study).pt. (644558)
- 15 (multicentre or multicenter or multi-centre or multi-center).ti. (31588)

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2 3	16	random\$.ti,ab. or controlled.ti. (809402)
4 5 6 7	17	(control adj3 (area or cohort? or compare? or condition or design or group? or intervention? or participant? or study)).ab. not (controlled clinical trial or randomized controlled trial).pt. (440969)
8 9	18	Aged/ (2394306)
10	19	"Aged, 80 and over"/ (647729)
11 12	20	older adults.mp. (38411)
13 14	21	elderly adults.mp. (2417)
15	22	over 65 years.mp. (3421)
16 17	23	virtual ward.mp. (12)
18		
19 20	24	intermediate care.mp. (1478)
21	25	Crisis response.mp. (103)
22 23	26	Crisis resolution.mp. (99)
24	27	reablement.mp. (12)
25 26	28	re-ablement.mp. (11)
27	29	hospital care at home.mp. (14)
28 29	30	hospital-at-home.mp. (289)
30	31	
31 32	32	home hospital.mp. (150) medical day hospital care.mp. (2) day hospital.mp. (2435) out-patient facility.mp. (13) Domiciliary care.mp. (247)
33	33	day hospital.mp. (2435)
34 35		aut notiont facility mp. (12)
36	34	out-patient facility.mp. (13)
37 38	35	Domiciliary care.mp. (247)
39	36	intermediate services.mp. (7)
40 41	37	Intermediate Care Facilities/ (639)
42	38	Home Care Services, Hospital-Based/ (1662)
43 44	39	Home Care Services, Hospital-Based/ (1662) Home Health Nursing/ (58)
45	40	Home Nursing/ (8049)
46 47	41	admission avoidance.mp. (56)
48 49	42	outreach program.mp. (677)
50	43	hospital outreach.mp. (27)
51 52	44	nursing-led units.mp. (3)
53		
54 55	45	hospital in home.mp. (8)
56	46	hospital in the home.mp. (123)
57 58	47	medical home care.mp. (39)
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- 49 Geriatric emergency management practice model.mp. (1)
- 50 day unit.mp. (169)
- 51 Day Care/ (4670)
- 52 day centre.mp. (170)
- 53 comprehensive elderly care.mp. (2)
- 54 Substitutive care.mp. (1)
- 55 shared care.mp. (916)
- 56 guided care.mp. (69)
- 57 home-based versus hospital-based.mp. (11)
- 58 home hospitalisation.mp. (28)
- 59 rapid response team.mp. (515)
- 60 rapid response nurse.mp. (2)
- 61 Hospitals, Community/ (10479)
- 62 \*Ambulatory Care/ (15963)
- 63 \*Health Services for the Aged/ (12112)
- 64 or/1-17 (3278427)
- 65 or/23-63 (57831)
- 66 or/18-22 (2428347)
- 67 64 and 65 and 66 (11288)
- 68 67 not (child/ or infant/ or adolescent/ or maternal health services/) (9807)
- 69 68 not (case report/ or case study/ or letter/ or editorial/ or expert opinion.mp.) [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier] (9192)
- 69 not (Algeria\$ or Egypt\$ or Liby\$ or Morocc\$ or Tunisia\$ or Western Sahara\$ or Angola\$ or Benin or Botswana\$ or Burkina Faso or Burundi or Cameroon or Cape Verde or Central African Republic or Chad or Comoros or Congo or Djibouti or Eritrea or Ethiopia\$ or Gabon or Gambia\$ or Ghana or Guinea or Keny\$ or Lesotho or Liberia or Madagasca\$ or Malawi or Mali or Mauritania or Mauritius or Mayotte or Mozambiq\$ or Namibia\$ or Niger or Nigeria\$ or Reunion or Rwand\$ or Saint Helena or Senegal or Seychelles or Sierra Leone or Somalia or South Africa\$ or Sudan or Swaziland or Tanzania or Togo or Ugand\$ or Zambia\$ or Zimbabw\$ or China or Chinese or Hong Kong or Macao or Mongolia\$ or Taiwan\$ or Belarus or Moldov\$ or Russia\$ or Ukraine or Afghanistan or Armenia\$ or Azerbaijan or Bahrain or Cyprus or Cypriot or Georgia\$ or Iran\$ or Iraq\$ or Israel\$ or Jordan\$ or Kazakhstan or Kuwait or Kyrgyzstan or Leban\$ or Oman or Pakistan\$ or Palestin\$ or Qatar or Saudi Arabia or Syria\$ or Tajikistan or Turkmenistan or United Arab Emirates

or Uzbekistan or Yemen or Bangladesh\$ or Bhutan or British Indian Ocean Territory or Brunei Darussalam or Cambodia\$ or India\$ or Indonesia\$ or Lao or People's Democratic Republic or Malaysia\$ or Maldives or Myanmar or Nepal or Philippin\$ or Singapore or Sri Lanka or Thai\$ or Timor Leste or Vietnam or Albania\$ or Andorra or Bosnia\$ or Herzegovina\$ or Bulgaria\$ or Croatia\$ or Estonia or Faroe Islands or Greenland or Liechtenstein or Lithuani\$ or Macedonia or Malta or maltese or Romania or Serbia\$ or Montenegro or Slovenia or Svalbard or Argentina\$ or Belize or Bolivia\$ or Brazil\$ or chile or Chilean or Colombia\$ or Costa Rica\$ or Cuba or Ecuador or El Salvador or French Guiana or Guatemala\$ or Guyana or Haiti or Honduras or Jamaica\$ or Nicaragua\$ or Panama or Paraguay or Peru or Puerto Rico or Suriname or Uruguay or Venezuela or developing countr\$ or south America\$).ti,sh. (8719)

- 71 admission\*.ab. (140603)
- 72 hospital\*.ab. (747796)
- 73 71 or 72 (804011)
- 74 70 and 73 (3851)
- 75 limit 74 to yr="2005 -Current" (1880)
- 76 remove duplicates from 75 (1829)

## Appendix 2: EPOC Risk of bias

## Paramedic (PP) / emergency care practitioner (ECP) interventions

#### Study: Mason 2007 RCT - older population with mixed conditions

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	Low risk	'We used cluster randomisation to reduce the risk of contamination (practice in the control group being influenced by the presence of the paramedic practitioner in the community) and to allow service level, rather than individual patient level, evaluation of the intervention. Weeks were randomised before the start of the study (to allow for rostering of the paramedic practitioners) to the paramedic practitioner service being active (intervention) or inactive (control), when the standard 999 service was available'
Was allocation adequately concealed?	Low risk	'Episode of care with some form of centralised randomisation scheme'
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. ED attendance
Were baseline characteristics similar?	Low risk	Baseline characteristics of intervention and control groups were reported and similar
Were incomplete outcome data adequately addressed?	Low risk	Flow of patients through trial was presented and intention-to-treat analysis used
Was knowledge of allocated interventions adequately prevented during study?	Low risk	Majority of outcomes were objective but there was one about satisfaction with service i.e. subjective
Was study adequately protected against contamination?	Low risk	'We used cluster randomisation to reduce the risk of contamination (practice in the control group being influenced by the presence of the paramedic practitioner in the community) and to allow service level, rather than individual patient level, evaluation of the intervention'.
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Nothing obvious

#### Study: Gray 2008 historical controls - older people with falls

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	High risk	'From January to April 2006 inclusive, all the patients seen by the ECP service who had rung 999 with a diagnosis of either breathing difficulties or an elderly patient (.65 years of age) with a fall were reviewed.' 'Comparison data were taken from January to April 2005 inclusive for attendances to the same ED for patients with the same criteria as above seen by non- ECP ambulance service personnel'
Was allocation adequately concealed?	High risk	As above
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. ED attendance
Were baseline characteristics similar?	Unclear risk	No details given other than 'elderly patients >65yrs with a fall'
Were incomplete outcome data adequately addressed?	Unclear risk	No reference to missing data or how it might be handled
Was knowledge of allocated interventions adequately prevented during study?	Low risk	Outcome measures were all objective
Was study adequately protected against contamination?	Low risk	Different data collection time-periods were reported for each group
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Only used half of the study population
Study: Mason 2012 'quasi experimental' - older population with mi	xed conditions	

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	High risk	'Potential 'intervention' trust sites were selected on the basis of their heterogeneity of service delivery of ECP care. 'Control'
		trust sites that did not employ ECPs, but were in close geographical proximity (i.e. within the same or in a neighbouring
		county) and which offered the same service configurations as the intervention trusts, were then selected'
Was allocation adequately concealed?	High risk	As above
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. ED attendance
Were baseline characteristics similar?	High risk	For the care home subgroup, figures were given on selected baseline characteristics but no formal comparison appeared to
	-	be made. On face value, clinical characteristics were not balanced e.g. adult medical 30 vs.41%, adult trauma 46 vs.13%
Were incomplete outcome data adequately addressed?	Unclear risk	No reference to missing data or how it might be handled
Was knowledge of allocated interventions adequately prevented during study?	Low risk	Outcome measures were all objective
Was study adequately protected against contamination?	Low risk	Intervention and control were delivered in different locations
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Nothing obvious

## Emergency Department (ED) interventions

#### Study: Sun 2014 RCT - syncope

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	Low risk	'Patients were block randomized (n=4) by site in a 1:1 ratio to either the observation protocol or routine inpatient admission
Was allocation adequately concealed?	Low risk	'A computer generated the study arm assignment at randomization, and no research personnel had advance knowledge o
		study arm assignment. We could not blind this health service intervention to patients, providers, or research personnel.'
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. inpatient admission rates
Were baseline characteristics similar?	Low risk	Baseline characteristics of intervention and control groups were reported and similar
Were incomplete outcome data adequately addressed?	Low risk	Flow chart of participants provided and intention-to-treat analysis performed
Was knowledge of allocated interventions adequately prevented during study?	Low risk	Outcome measures were objective but one secondary outcome - participant satisfaction - was subjective
Was study adequately protected against contamination?	Unclear risk	Treatment and control were allocated and delivered in same location so possible for participants to swap allocation
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Nothing obvious

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	High risk	'Trained research assistant (VM) screened patients presenting to the ED for Monday to Friday from 9:00 a.m to 6:00 p.m using a standard information sheet explaining the study protocol to patients and proxies'
Was allocation adequately concealed?	High risk	As above
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. number of initial admissions
Were baseline characteristics similar?	High risk	Intervention and control groups were unbalanced – age, 78.1(7) vs.82.5(7.2) p<0.001, female 47 vs. 68% p=0.004, marrie 70 vs. 40% p<0.001, SPMSQ 2.5(3.3) vs. 5.2(4.2) p<0.001, ADL4.3(2) vs. 3.2(2.5) p=0.001
Were incomplete outcome data adequately addressed?	Unclear risk	No reference to missing data or how it might be handled
Was knowledge of allocated interventions adequately prevented during study?	Low risk	All outcome measures were objective
Was study adequately protected against contamination?	Unclear risk	Treatment and control were delivered in different locations
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Nothing obvious

#### Study: Benaiges 2014 CT - hyperglycaemia

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	High risk	'Patients were assigned to the DH group if they were admitted to hospital within DH opening hours (weekdays from 8:00 a.m
	-	to 4:00 p.m); otherwise they were treated in the emergency department and subsequently hospitalized'
Was allocation adequately concealed?	High risk	As above
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. number of ER visits
Were baseline characteristics similar?	Low risk	Baseline characteristics of treatment and control groups were reported and similar
Were incomplete outcome data adequately addressed?	Unclear risk	No reference to missing data or how it might be handled
Was knowledge of allocated interventions adequately prevented during study?	Low risk	All outcome measures were objective
Was study adequately protected against contamination?	Low risk	'Patients were treated with same protocol for both DH and CH' so contamination was possible
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Nothing obvious

## Community hospital interventions

#### Study: Vicente 2014 RCT

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	Low risk	'The dispatchers at the EMCC randomized older adults into the study. A sealed envelope randomization procedure was initiated when the dispatcher received the incoming call and identified the participant as an individual aged 65 who resided in the specified geographical area and was assigned a priority level 2 or 3, and the call occurred between 8:00 a.m. and 10:00 p.m'
Was allocation adequately concealed?	Low risk	'The envelope contained the name of the EMS Company 1 or the name of the EMS Company 2. There was an equal chance (1:1) of being assigned to either of the ambulance companies'
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. number of individuals sent direct to community hospital
Were baseline characteristics similar?	High risk	There was a difference in the priority level when ambulance sent out (% individuals) – Level 1) 1.6 vs. 0%, Level 2) 59 vs. 47%, Level 3) 39 vs.53%, p=0.001
Were incomplete outcome data adequately addressed?	Unclear risk	No reference to missing data or how it might be handled
Was knowledge of allocated interventions adequately prevented during study?	Low risk	All outcome measures were objective
Was study adequately protected against contamination?	Low risk	Separate sealed envelope opened for each individual case
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Nothing obvious

### Study: Garasen 2007/8 ab RCT - older population with mixed conditions

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	Low risk	When an eligible patient was identified and accepted for inclusion, a blinded randomisation was performed by the
		Clinical Research Department using random number tables in blocks to ensure balanced groups'
Was allocation adequately concealed?	Low risk	As above
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. number of readmissions for index
		disease
Were baseline characteristics similar?	Unclear risk	Baseline characteristics of intervention and control groups were described but no formal comparison reported
Were incomplete outcome data adequately addressed?	Unclear	No reference to missing data or how it might be handled
Was knowledge of allocated interventions adequately prevented during study?	Low risk	All outcome measures were objective
Was study adequately protected against contamination?	Low risk	Participants were allocated using a clear process but 8 individuals originally assigned to CH were later assigned to GH
Was study free from selective outcome reporting?	Low risk	All outcomes described in methods section were reported in results section plus 12-month data was used in Garasen 2008
	L aux rials	N a th is an a built and
Was study free from other risks of bias?	Low risk	Nothing obvious
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was study free from other risks of blas?	LOW ISK	Nothing obvious
Was study free from other risks of blas?	LOW IISK	Nothing obvious
Was study free from other risks of blas?		Nothing obvious
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		Nothing obvious
Hospital-at-Home (HAH) interventions: heart		Nothing obvious
		Nothing obvious
Hospital-at-Home (HAH) interventions: heart		Nothing obvious
		Nothing obvious

## Hospital-at-Home (HAH) interventions: heart failure

#### Study: Patel 2008 pilot RCT - heart failure

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	Low risk	Open pilot RCT
Was allocation adequately concealed?	Unclear risk	Used 'random number generator under direction of specialist nurse or hospital admission staff' but no further detail provided
Were baseline outcome measurements similar?	Low risk	Mostly not relevant since majority of outcomes were related to process
Were baseline characteristics similar?	Low risk	Baseline characteristics of intervention and control groups were reported and small differences seen in gender, education
		and two particular co-morbidities
Were incomplete outcome data adequately addressed?	High risk	Flow of patients was described although description of analysis was lacking
Was knowledge of allocated interventions adequately prevented during study?	Unclear risk	No detail provided
Was study adequately protected against contamination?	Low risk	Treatment and control were delivered in different locations
Was study free from selective outcome reporting?	Unclear risk	Difficult to understand the description of outcomes in methods section but all were reported in results section
Was study free from other risks of bias?	Unclear risk	Description of analysis and results was possibly too assertive for a feasibility study

#### Study: Mendoza 2009/Garcia-Soleto 2013 RCT - heart failure

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	Low risk	'Randomly assigned (1:1) to one of the intervention groups according to an externally generated sequence, which was hidden from the clinicians until the patient had given consent to participate'
Was allocation adequately concealed?	Low risk	As above
Were baseline outcome measurements similar?	Low risk	Mostly not relevant since outcomes were related to process but functional status and health-related QoL were similar
Were baseline characteristics similar?	Low risk	Baseline characteristics of intervention and control groups were reported and similar
Were incomplete outcome data adequately addressed?	Low risk	Patient flow through trial was described and 'per protocol' analysis performed
Was knowledge of allocated interventions adequately prevented during study?	Unclear risk	No detail provided
Was study adequately protected against contamination?	Low risk	Treatment and control were delivered in different locations
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Nothing obvious

#### Study: Tibaldi 2009 RCT - heart failure

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	Low risk	'By the use of a set of computer-generated random numbers in a 1:1 ratio. The allocation sequence was unknown to any of
		the investigators and was contained in a set of sealed envelopes, each bearing on the outside only the name of the hospital
		and a number, which was opened after the acceptance of the patient'
Was allocation adequately concealed?	Low risk	Participants were enrolled within 12-24 hours of ED admission by research assistants, masked to both allocation and
		hypotheses being tested
Were baseline outcome measurements similar?	Low risk	Mostly not relevant since outcomes were related to process but depression, function and nutrition measures were similar
Were baseline characteristics similar?	Unclear risk	Baseline characteristics of intervention and control groups were reported and heart rate was significantly different p=0.006
Were incomplete outcome data adequately addressed?	Low risk	Patient flow through trial described and intention-to-treat analysis performed
Was knowledge of allocated interventions adequately prevented during study?	Unclear risk	No detail available
Was study adequately protected against contamination?	Low risk	Treatment and control were delivered in different locations
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Nothing obvious
Uponital at Hama (HAH); CODD		
Hospital-at-Home (HAH): COPD		
Study: Ricauda 2008 RCT - COPD		
Bias	Authors' judgement	Support for judgement

## Hospital-at-Home (HAH): COPD

#### Study: Ricauda 2008 RCT - COPD

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	Low risk	Patients were randomised using a set of computer-generated random numbers in a 1:1 ratio.
Was allocation adequately concealed?	Low risk	Allocation sequence was unknown to any of the investigators and kept in a set of sealed envelopes, each bearing on the outside only the name of the hospital and a number. After acceptance of a patient, the ED nurse coordinator, who was not involved in the study, opened the appropriately numbered envelope
Were baseline outcome measurements similar?	Low risk	Mostly not relevant since outcomes were related to process but clinical outcomes e.g. depression were similar
Were baseline characteristics similar?	Low risk	Recorded in DE table
Were incomplete outcome data adequately addressed?	Low risk	Drop outs/loss-to-follow-up were recorded and intention-to-treat analysis performed
Was knowledge of allocated interventions adequately prevented during study?	Unclear risk	Single-blind study since patients were aware of the treatment assignment although physicians and nurses evaluating patients were blinded to the patient's allocation
Was study adequately protected against contamination?	Low risk	Treatment and control were delivered in different locations
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Nothing obvious

### Hospital-at-Home (HAH): Pulmonary embolism

### Study: Rodriguez-Cerillo 2009 nRCT - non-massive pulmonary embolism

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1

### Study: Carratala 2005 open RCT - pneumonia

Bias	Authors' judgement	Support for judgement		
Was allocation sequence adequately generated?	Low risk	Randomisation was performed by using a computer-generated random code with a block size of 10		
Was allocation adequately concealed?	Low risk	Randomisation was stratified by hospital site, and the random code was held centrally, in a sealed envelope, by the clinical epidemiologist. In the emergency department, the infectious disease consultant (in most cases not a study investigator) opened sealed, sequentially numbered opaque envelopes to randomly assign patients who had provided written informed consent and met the study criteria		
Were baseline outcome measurements similar?	Low risk	Mostly not relevant since outcomes were related to process		
Were baseline characteristics similar?	Low risk	Detailed in DE table		
Were incomplete outcome data adequately addressed?	Low risk	Patient flow through trial was reported and intention-to-treat analysis performed		
Was knowledge of allocated interventions adequately prevented during study?	Unclear risk	Trial was described as 'unblinded '		
Was study adequately protected against contamination?	Low risk	Treatment and control were delivered in different locations		
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section		
Was study free from other risks of bias?	Unclear risk	Lack of blinding in terms of assessment could be problematic		
Hospital-at-Home (HAH): Stroke		0		
Study: Kalra 2005 RCT - stroke				

### Hospital-at-Home (HAH): Stroke

#### Study: Kalra 2005 RCT - stroke

Bias	Authors' judgement	Support for judgement		
Was allocation sequence adequately generated?	Low risk	Randomisation was not stratified and was undertaken using the block randomisation technique. This ensured that the		
		number of patients allocated to the stroke unit or to domiciliary services at any one time did not exceed their capacity		
Was allocation adequately concealed? Unclear risk		Randomisation was conducted in blocks of 30 in an office remote from patient treatment areas, so that it would not be		
		possible for those enrolling patients to guess allocation for the vast majority of subjects		
Were baseline outcome measurements similar?	Low risk	Mostly not relevant since outcomes were related to process		
Were baseline characteristics similar? Low risk		Baseline characteristics with regard to stroke type, severity, level of impairment and initial disability were well-matched		
		across the three groups		
Were incomplete outcome data adequately addressed?	Low risk	Patient flow through trial was reported and intention-to-treat analysis performed		
Was knowledge of allocated interventions adequately prevented during study?	Unclear risk	No detail provided		
Was study adequately protected against contamination?	Unclear risk	Patients were brought to hospital from domiciliary care if that was considered to be clinically appropriate		
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section		
Was study free from other risks of bias?	High risk	In order to ensure that participants were treated in the most appropriate setting, swapping of groups was possible		

### Hospital-at-Home (HAH): Uncomplicated diverticulitis

#### Study: Rodriguez-Cerrillo 2013 nRCT - uncomplicated diverticulitis

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	High risk	nRCT
Was allocation adequately concealed?	High risk	As above
Were baseline outcome measurements similar?	Low risk	Mostly not relevant since outcomes were related to process
Were baseline characteristics similar?	Low risk	Very limited details provided about age, gender and presenting complaint
Were incomplete outcome data adequately addressed?	High risk	No flow of patients was given and only basic analysis reported
Was knowledge of allocated interventions adequately prevented during study?	High risk	No detail provided
Was study adequately protected against contamination?	Low risk	Treatment and control were delivered in different locations
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Unclear risk	Both analysis and reporting of results were limited

### Hospital-at-Home (HAH): Mixed population

#### Study: Leff 2005/2009 'quasi experimental' - older population with mixed conditions

Bias	Authors' judgement	Support for judgement		
Was allocation sequence adequately generated?	High risk	During the acute care hospital observation phase (1 November 1990 to 30 September 2001), eligible patients were		
		identified and followed through usual hospital care. During the intervention phase (1 November 2001 to 30 September		
		2002), eligible patients were identified at the time of admission and were offered the option of receiving their care in		
		hospital-at-home rather than in the acute care hospital'		
Was allocation adequately concealed?	High risk	As above		
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. time before evaluation		
Were baseline characteristics similar?	High risk	Populations differed in measures of poverty, living alone and medication. This was acknowledged but not adjusted for.		
Were incomplete outcome data adequately addressed?	Low risk	Intention-to-treat analysis was conducted although there were substantial missing data e.g. in relation to functional status		
Was knowledge of allocated interventions adequately prevented during study?	Low risk			
		living as an outcome		
Was study adequately protected against contamination?	Low risk	ow risk Unlikely that control group received intervention and vice versa. Rather, patients were allocated HaH or admitted		
		HaH was unacceptable they were admitted		
Was study free from selective outcome reporting?	Low risk	All outcomes described in methods section were reported in results section. Whilst there is no mention of activities of da		
, , , , , , , , , , , , , , , , , , ,		living in Leff 2005, this outcome was reported in Leff 2009		
Was study free from other risks of bias?	Unclear risk	Possible selection bias related to differences in baseline characteristics e.g. functional status		
•		· · · · · · · · · · · · · · · · · · ·		
Study: Lau 2003 historical controls				

#### Study: Lau 2003 historical controls

Bias	Authors' judgement	Support for judgement		
Was allocation sequence adequately generated?	High risk	Control trial with historical control group		
Was allocation adequately concealed?	Illocation adequately concealed? High risk As above			
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. palliative care received		
Were baseline characteristics similar? High risk?		There was an imbalance in patient characteristics which may have been due to recruitment bias since the provider was responsible for recruiting patients into the trial. There were more dementia patients treated outside of hospital – although presumably their symptoms were 'fairly mild' since more pronounced behavioural problems were excluded from HaH group		
Were incomplete outcome data adequately addressed?	Unclear risk	No reference to missing data or how it might be handled		
Was knowledge of allocated interventions adequately prevented during study?	Low risk	All outcomes were objective		
Was study adequately protected against contamination?	Low risk	Unlikely that control group received intervention and vice versa. Rather, patients were allocated HaH or admitted and, if HaH was unacceptable they were admitted		
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section		
Was study free from other risks of bias?	Low risk	Nothing obvious		

#### Study name: Crilly 2010 'quasi experimental' - older population with mixed conditions

as allocation sequence adequately generated?	Authors' judgement	Support for judgement
	High risk	Intervention group included 62 Aged Care Facility (ACF) residents who were enrolled in the Hospital in Nursing home programme during the first 12 months that the programme was operational, from 1 July 2003–30 June 2004. All sample
		members were ACF residents who presented to the ED and were subsequently admitted to hospital
as allocation adequately concealed?	High risk	As above
ere baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. palliative care received
ere baseline characteristics similar?	Low risk	Baseline characteristics of the study and control are reported and similar
ere incomplete outcome data adequately addressed?	Unclear	No reference to missing data or how it might be handled
as knowledge of allocated interventions adequately prevented during study?	Low risk	All outcomes were objective
as study adequately protected against contamination?	Low risk	Unlikely that control group received intervention and vice versa. Rather, patients were allocated HaH or admitted and, it HaH was unacceptable they were admitted
as study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
as study free from other risks of bias?	2011 1101	
		HaH was unacceptable they were admitted All outcome measures described in methods section were reported in results section Nothing obvious

### Appendix 3: AMSTAR ratings of systematic reviews

Study	Was an 'a priori' design provided?	Was there duplicate study selection and data extraction?	Was a comprehensive literature search performed?	Was the status of publication (i.e. grey literature) used as an inclusion criterion?	Was a list of studies (included and excluded) provided?	Were the characteristics of the included studies provided?	Was the scientific quality of the included studies assessed and documented?	Was the scientific quality of the included studies used appropriately in formulating conclusions?	Were the methods used to combine the findings of studies appropriate?	Was the likelihood of publication bias assessed?	Was the conflict of interest included?
Caplan 2012	YES	YES	YES	YES	NO excluded studies not listed	NO studies were grouped by medical, surgical, rehabilitation and psychiatric	YES	YES	YES	YES	YES
Chalmers 2011	YES	YES	YES	NO	NO excluded studies not listed	YES but no ages and no direct reporting of participants in either group	YES but not detailed and whilst Cochrane was cited only one RCT involved	YES	UNCLEAR difficult to judge whether combination of study types is commonly accepted	No	YES
Jeppensen 2012 (Cochrane)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Qaddoura 2015	YES	YES	YES	YES	NO excluded studies not listed	YES	YES	NO relatively high risk of bias but all available data used	NO meta-analysis of two RCTs plus combination of different QoL measures from same study in meta-analysis	NO	YES
Shepperd 2016 (Cochrane)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Varney 2014	YES	NO used single reviewer	YES	YES	NO	YES	YES	NO	N/A no data were combined	NO	YES
<b>Vinson</b> 2012	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	NO

### Appendix 4: description of interventions included in systematic review

Intervention	Description
Paramedic practitioner (PP) / emergency care practitioner (ECP) interventions	PPs/ECPs can be trained to 'assess and treat' or to refer patients with a range of conditions, as part of pre-hospital care. These roles were created in order to provide a more appropriate response to patients needs in emergency and urgent care settings. Their main purpose is to improve the pathway of care and patient experience, particularly by discharging patients at the scene or by referring on to the most appropriate care practitioner, reducing unnecessary emergency department (ED) attendance and avoidable admissions.
Community hospital (CH) interventions	The role of CHs varies between country and health systems but, essentially, their main role is to provide non-urgent i.e. routine or rehabilitative care. However, their role can be extended to provide an alternative to acute hospital (AH) admission for appropriate cases.
Emergency department (ED) interventions	These involve initial assessment in the ED, followed by an extended stay for tests and observation. This extended stay is in a bed closely associated with the ED, if not part of it.
Hospital-at-home (HaH) interventions	HaH services provide acute or sub-acute treatment in a patient's residence for a condition that would normally require admission to hospital. It is also known as 'hospital in the home' and 'home hospitalisation'.
Hospital in nursing/care home (HNCH) interventions	HNCH is as a model of admission avoidance to treat patients living in nursing and residential care homes, working on the same principles as HaH for community-dwelling residents.

### Appendix 6: Characteristics of those older patients for whom the decision to admit to hospital may be unclear

Patient characteristics	Studies which include such populations			
Age ≥75 years	15/19 studies			
for included patients	Mason 2007 & 2012; Benaiges 2014; Salvi 2008; Garasen 2007; Vincente 2014; Patel 2008; Mendoza 2009; Tibaldi 2009; Ricauda 2008; Kalra 2005; Rodriguez-Cerillo 2013 Leff 2005; Crilly 2010; Lau 2013			
Co/multi-morbidities	9/19 studies			
in included patients stated either by number of conditions or multi-morbidity score e.g. Charlson Score	Benaiges 2014; Salvi 2008; Patel 2008; Mendoza 2009; Tibaldi 2009; Ricauda 2008; Carratala 2005; Leff 2005; Lau 2013			
Dementia	a) 2/19 studies			
either stated in a) patient demographics or b) used as an exclusion criterion based on severity	Rodriguez-Cerillo 2009; Lau 2013			
	b) 8/19 studies			
	Mason 2007; Sun 2014; Salvi 2008; Garasen 2007; Mendoza 2009; Tibaldi 2009; Ricauda 2008; Lau 2013			
Social care support	3/19 studies			
stated in inclusion/exclusion criteria	Tibaldi 2009; Ricauda 2008; Kalra 2005;			
Home situation	7/19 studies			
stated in inclusion/exclusion criteria	Benaiges 2014; Garasen 2007; Mendoza 2009; Ricauda 2008; Rodriguez-Cerillo 2009, 2013; Lau 2013			
Individual coping abilities	2/19 studies			
stated in inclusion/exclusion criteria	Patel 2008; Rodriguez-Cerillo 2013			



### **PROSPERO International prospective register of systematic reviews**

# A systematic review to identify and assess the effectiveness of hospital alternatives for people over the age of 65 who are at risk of potentially avoidable hospital admission

Alyson Huntley, Melanie Chalder, Will Hollingworth, Chris Metcalfe, Ben Davies, Sarah Purdy

### Citation

Alyson Huntley, Melanie Chalder, Will Hollingworth, Chris Metcalfe, Ben Davies, Sarah Purdy. A systematic review to identify and assess the effectiveness of hospital alternatives for people over the age of 65 who are at risk of potentially avoidable hospital admission. PROSPERO 2015:CRD42015020371 Available from http://www.crd.york.ac.uk/PROSPERO\_REBRANDING/display\_record.asp?ID=CRD42015020371

### **Review question(s)**

1) What admission alternatives are there for older patients and do they improve patient outcomes e.g. mortality, quality of life?

2) What are the defining characteristics of those older patients for whom the decision to admit to hospital may be unclear?

### Searches

MEDLINE, MEDLINE in process, EMBASE, CINAHL and the Cochrane Central Register of Controlled Trials (CENTRAL) from 2005 to April 24th 2015. The Kings Fund and AHRQ websites were also searched

### Types of study to be included

Any type of controlled study

### Condition or domain being studied

Any condition that may result in an avoidable hospital admission in patients over the age of 65.

### Participants/ population

People over 65 years of age of either sex living in OECD countries who are at risk of an unplanned admission (probably for an ambulatory sensitive condition) - they will therefore not be admitted to hospital at time of recruitment but could be in community or emergency department (being assessed).

### Intervention(s), exposure(s)

The intervention of interest is admission to hospital, using definitions developed for previous studies (Huntley et al, Family Practice Fam Pract. 2013 Jun;30(3):266-75.). However it is important to point out that admission is likely to be the control group in many relevant studies.

### Comparator(s)/ control

Alternatives to admission (likely to be described as the intervention) including but not limited to: hospital at home, virtual ward, rapid response nursing, care at home, admission to a care home, usual care.

### Context

Reducing emergency bed days is one of the biggest challenges currently facing the National Health Service (NHS). There is considerable pressure to reduce hospital admissions amongst older people (D'Souza, BMJ 2013). There has been a 65% increase in hospital admissions for those over 75 years of age in the last decade ,and the oldest old, those over 85 years , now account for 11% of emergency admissions and 25% of bed days (NHS England 2013). There are some older people for whom care in the community is safe,perhaps with the provision of additional services and some for whom admission is required in order to deliver diagnostic or treatment techniques that are only available as an in patient. This review seeks to identify interventions for those patients that do not fall neatly into one of these categories and in doing so will assess the efficacy of the interventions and provide more detail on this patient

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population.

### **Outcome(s)**

**Primary outcomes** 

1) Patient outcomes (including mortality, quality of life, length of stay, readmission, adverse effects of intervention) plus costs if available.

2) Patient characteristics for whom their pathway (admission or not) is unclear including risk factors e.g. comorbidities (mental & physical), age, gender, social circumstances ,disease severity, recent admission/discharge availability of other services

Secondary outcomes

None

### Data extraction, (selection and coding)

Standardised data extraction forms will be developed using existing guidelines (Higgins 2008 Cochrane handbook chapter 7 section 7.5). Data will be abstracted by one reviewer. A second reviewer will check data abstraction against the original paper. Data items: details on participants, Interventions, comparisons, outcome measures

### Risk of bias (quality) assessment

Cochrane risk of bias tool will be used for randomised controlled trials. CASP criteria will be used for controlled trials

### Strategy for data synthesis

Meta-analysis of data will be performed using Review Manager Version 5.1 if there are at least three trials with combinable data with a fixed or random effects model depending on the level of between trial heterogeneity estimated using the I-squared statistic. Sensitivity analysis will be performed as the data dictates.

### Analysis of subgroups or subsets

Dependent on data found

### **Dissemination plans**

This review is part of programme development grant.

### **Contact details for further information**

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### Collaborators

Dr Ali Heawood, University of Bristol Mrs Helen England, BrisDoc Professor Jonathan Benger, University of the West of England

### Details of any existing review of the same topic by the same authors

None

Anticipated or actual start date 02 February 2015

### Anticipated completion date

29 January 2016

**Funding sources/sponsors** NIHR Programme Development Grant RP-DG-1213-10004

### **Conflicts of interest**

None known

### Language

English

### Country

England

### Subject index terms status

Subject indexing assigned by CRD

### Subject index terms

Hospitalization; Hospitals; Humans

### Stage of review

Ongoing

### **Date of registration in PROSPERO** 14 May 2015

## Date of publication of this revision

14 May 2015

### DOI

10.15124/CRD42015020371

Stage of review at time of this submission	Started	Completed
Preliminary searches	No	Yes
Piloting of the study selection process	No	Yes
Formal screening of search results against eligibility criteria	Yes	No

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National Institute for Health Research

Data extraction	No	No
Risk of bias (quality) assessment	No	No
Data analysis	No	No

### **PROSPERO**

The information in this record has been provided by the named contact for this review. CRD has accepted this information in good faith and registered the review in PROSPERO. CRD bears no responsibility or liability for the content of this registration record,



## PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Page 1
ABSTRACT			
2 Structured summary 3	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	Pages 2-3
Rationale	3	Describe the rationale for the review in the context of what is already known.	Page 5
9 9 9	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	Pages 5-6
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	Page 6
5 Eligibility criteria 6	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	Page 6
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	Page 6
9 Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Appendix 1
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	Pages 6-7
5 Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	Page 7
8 Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	Page 7
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	Page 7
3 Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	N/A
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I <sup>2</sup> ) for each meta-analysis.	Page 8
7 8 9		For peer review only - http://bmjopen.bmj.com/site/about/guidelines.xhtml Page 1 of 2	

### **PRISMA 2009 Checklist**

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	Page 7
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	n/a
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	Page 8 and Figure 1
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Pages 8-17
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	Pages 8-17 and Appendices 2 & 3
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Pages 8-17 and Appendix 5
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	Pages 8-17 plus narrative presentation
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	Pages 8-17
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	n/a
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	Page 18
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	Pages 18-19
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	Page 19
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	Page 21

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*From:* Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. 46 doi:10.1371/journal.pmed1000097 

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### Appendix 5 : Detail of included studies

### Paramedic/ECP) interventions (n=3)

Author Year	Study	Participants	Intervention	Control	Outcomes assessed	Results
Country						
Mason	Cluster RCT by service	Inclusion criteria:	A paramedic practitioner	A paramedic	Relevant measures &	Intervention vs. control
		Patients aged ≥60yrs recruited	based in the ambulance	practitioner based in	outcomes	
2007	56 clusters	from 1 Sep 2003- 26 Sep 2004.	control room identified	the ambulance control		Primary outcomes
		Call originated from a Sheffield	eligible calls by the	room identified eligible	Primary outcomes	ED attendance (28 days)
UK	Intervention:	postcode between 8am-8pm, with	presenting complaint and	calls by the presenting	ED attendance	970 (62.6%) vs. 1286 (87.5%
	paramedic practitioner service	a presenting complaint that fell within the scope of practice of the	notified a paramedic practitioner. All identified	complaint and notified a paramedic	ED attendance Hospital admissions within	p<0.001
	n=1469	paramedic practitioners.	patients were approached	practitioner	28 days	Hospital admissions (28 day
	11-1405	parametic practitioners.	face to face either in the	in the ED	Time of call to time of	626 (40.4%) vs. 683 (46.5%)
	Control:	Exclusion criteria:	community or in ED for	in the ED	discharge	p<0.001
	Inactive paramedic	None given	written consent to follow-	Procedure continued	Patient satisfaction survey	P
	practitioner service		up. Patients who had more	as for intervention	including the EQ-5D	Mean Time of call (SD) to til
	n=1549	'If patients were unable to	than one eligible episode		, , , , , , , , , , , , , , , , , , ,	of discharge in mins
		complete questionnaires e.g.	were recruited only once.		Secondary outcomes	235.1(183.3) vs. 277.8(182.6
		because of cognitive impairment	The research team			p<0.001
		or who were unable to read	independently checked the			
		English—we obtained consent for	ambulance service call		Subsequent unplanned	Patient satisfaction survey
		follow-up by review of clinical	database at the end of each		contact with secondary	including the EQ-5D
		records only.	month for any additional		care at 28 days	Very satisfied with care 656
			eligible calls not identified			(85.5%)vs.528 (73.8%)
		Baseline characteristics of	These were checked for		Mortality at 28 days	p<0.001
		participants	selection bias but not			
		Intervention vs. control	followed up. Scope of			Secondary outcomes
		Mean age (SD)	practice of paramedic			C. have been descended
		82.6(8.3) vs. 82.5(8.3) yrs Women %	practitioners: Falls,			Subsequent unplanned
		72 vs.73%	Lacerations, Epistaxis, Minor burns, Foreign body in ear,		1	contact with secondary care 330(21.3%) vs. 259 (17.6%)
		Living in on own home %	nose, or throat, Local			p<0.01
		78vs.78 %	anaesthetic techniques,			p<0.01
		Presenting complaint %	Wound care and suturing			Mortality at 28days
		Fall 88 vs.89%	techniques, Principles of			68(4.4%) vs.74(5%) p=0.41
		Haemorrhage 6 vs.5%	dressings and splintage,			
		Acute medical condition	Joint examination,			
		6vs.5%	Examination of neurological,			
			cardiovascular, and			
			respiratory system,			
			Examination of ear, nose,			21
			and throat, Protocol led			
			dispensing: simple			
			analgesia, antibiotics,			
			tetanus toxoid, Assessment			
			of mobility and social needs,			
			Additional options for referral and requesting			
			investigations, Requests for			
			radiography, Referral			
			processes: emergency			
			department, general			
			practitioner, district nurse,			
			community social services			

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<b>,</b> [	Author	Study	Participants	Intervention	Control	Outcomes assessed	Results
1	Year						
2	Country						
3	Gray	COS with historical	The study included two groups of	Outline of intervention	Outline of control	Relevant measures &	ECP vs. ED
3		controls	patients a) those with breathing		Comparison data taken	outcomes	
4	2008		difficulties & b) elderly patients	Jan-April 2006 inclusive, all	Jan- April 2005		Outcome on initial contact:
5		Intervention:	>65yrs with a fall. The latter only is	the patients seen by the ECP	inclusive for	Outcome on initial contact:	Stayed at home (PC
-	UK	Emergency care	reported here.	service who had rung 999	attendances to same		referral)/went home
6		practitioner (ECP)		and were an elderly patient	ED for patients with	Treated at and stayed	171 vs. 369
7		intervention	Inclusion criteria:	(>65yrs) with a fall were	the same criteria as	home	(73% vs. 48% avoidable
'		n=233	Elderly patients >65yrs with a fall.	reviewed. Each patient seen	above & seen by		admission rate)
8			Exclusion criteria:	by an ECP was searched	non-ECP ambulance	ED and or admitted	
9		Control:	None given	for in the hospital records	service personnel.		At 72hr:
-		Historical control group		for ED attendance or	These dates were	At 72hrs & 28 days	21/171 (intervention grp)
10		from ED	Baseline characteristics of	admissions in 72 h and 28	chosen because, during	At home	attended ED and or were
11		n=772	participants	days following	this time, the ECP	ED attendance	admitted
				attendance by an ECP	service was not tasked	Admission	
12			None given		to patients with		At 28 days:
13					breathing difficulties		A further 19 (intervention grp)
					and Yorkshire	Costs	attended ED and or were
14					Ambulance Service had	None	admitted
15					only 12 operational		
16					ECPs during this		Avoidable admission rate
					comparison period		(intervention grp) at 28 days
17					compared with 24		was 56% ( 17% better)
18					whole-time equivalent		compared to control group
					operational ECPs		p<0.05
19					during the		
20					study period		
		l	1			l	I J
21							

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### **BMJ Open**

Author	Study	Participants	Intervention	Control	Outcomes assessed	Results
Year						
Country						
Mason	COS	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	Discharged with no further
2012	Internetica.	Informed consent was obtained	No data il	No dotoil	outcomes	follow up by any health
2012	Intervention: Five teams of Emergency	from all study participants prior to recruitment. Within each pair of	No detail	No detail	Using paired services	professional 49.2 vs.12.4%
UK	Care Practitioners (ECP)	services all patients presenting			Using parred services	49.2 vs.12.4% MD 36.8% (95% CI 26.7,46.8)
UK	n= 256 for care home	with emergency or urgent			Primary outcomes	1010 30.8% (35% C1 20.7,40.8)
	cohort	complaints that were eligible to be			Thinki y outcomes	Urgently referred to hospital
	Control:	seen by ECPs and presented to			% of patients	(both ED or direct admission)
	Five usual care providers	either the intervention or the			Discharged following	22.7 vs. 87.6%
	n=201 for care home	control services between May			consultation with no	MD -64.9% (95% CI
	cohort	2006 and August 2007 were			further follow up by any	-71.8 ,58.0)
)		included in the trial.			health professional	
		Exclusion criteria:				
		No detail			Urgently referred to	Non-urgently referred to GP
2					hospital (both ED or direct	or community care
3		Baseline characteristics of			admission)	28.1vs. 0%
Ļ		participants				28.1% (22.6,33.7)
		(no stats given)			Non-urgently referred to GP	Entrada Alma forme front
		Care home cohort			or community care	Episode time from first
5		Intervention vs. control			Secondary outcomes	contact to discharge median in mins (IQR)
		Mean age 83.5(10.40 vs. 84.5(8.5) yrs			(relevant ones only)	60 (40,80) vs. 39 (29,58)
		83.3(10.40 VS. 84.3(8.3) VIS			(relevant ones only)	Time ratio
		% Female			Episode time from first	1.36 (1.24,1.49)
		68 vs.66%			contact to discharge	1.50 (1.2.1)1.15)
		Clinical complaint %				
		Adult medical 30 vs.41 %				
		Adult trauma 46 vs.13 %				
		Elderly falls 23vs.46%			7	
						071

### ED Interventions (n=3)

	ED Interventions (n=:	,				
Author	Study	Participants	Intervention	Control	Outcomes assessed	Results
Year						
Country						
Sun	RCT	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	Observation vs. s care
		Patients aged≥ 50 years or older	Patients received	The syncope protocol was	outcomes	Inpatient
2014	Intervention:	diagnosed with intermediate	continuous cardiac	not used. Contamination		admission rates
	ED observation syncope	syncope.	monitoring ≥ 12hrs. ≤2	between groups was	Primary outcomes	9 (15%) vs. 57 (92%)
USA	protocol		serial cardiac troponin	minimized by being	Inpatient admission rates	Relative rate 0.16 (95%CI
	n=62	Exclusion criteria	tests approx. 6 hours	managed in distinct	Hospital LOS at indexed	0.09,0.29, p<0.001)
		Patients with a serious condition:	apart to exclude acute	physical spaces by	visit	Hospital LOS at indexed visit
	Control:	symptomatic arrhythmias,	MI. Rest echocardiogram	different clinical services.		mean SD (hrs) 29 (15) vs.
	Normal In-patient	myocardial infarction, pulmonary	for patients with cardiac		Secondary outcomes	47hrs (34) (p<0.001)
	admission	embolism, acute pulmonary	murmur, if not performed	Intervention delivered	30 day and 6mth serious	Serious events
	n=62	edema, stroke, severe anaemia or	in previous 6mths.	by:	events	During hospital visit
		blood loss requiring blood	Additional testing as	No detail	Index and 20 day benefited	Death 0 vs. 0
		transfusion, sepsis, and major	required. Maximum stay		Index and 30 day hospital	Arrhythmia 2 vs. 2
		traumatic injury. Also: seizure, head trauma, or	in observation unit could not be more than 24hrs.		costs 30 days changes in QoL	Pacemaker insertion 1vs.1
		intoxication as reason for loss of	Observation protocol		30 days changes in QoL 30 day patient satisfaction	Syncope with bone fracture
		consciousness; new/ baseline	patients who received a		so any patient sutisjaction	2 vs.1
		cognitive impairment; do-not-	diagnosis detailed in			30 days recurrent syncope 1
		resuscitate or do-not-intubate	exclusion list or had			vs 1
		status; active chemotherapy and	pending tests at 24hrs			30 day serious outcomes after
		inability to speak either	were admitted			discharge 2 vs. 0
		English/Spanish. Met high risk	High Risk Criteria			6mth serious outcomes
		criteria.	Serious condition identified in			after hospital discharge
		Baseline characteristics of	the ED, History of ventricular			4 vs.5
		participants	arrhythmia, Cardiac device with dysfunction, Exertional			Costs \$ (SD)
		Observation vs. control	syncope, Presentation			At index visit
		Mean(SD) or%	concerning for acute coronary			1,400(1,220) vs.2,420(3,930)
		Mean age	syndrome, Severe cardiac			Within 30 days
		65 (11) vs. 64(11)	valve disease (e.g., aortic			1,800(2,150) vs.2,520(3,980)
		% Female	stenosis <1 cm2), Known cardiac ejection faction <40%			Change in quality of life mean
		53 vs. 48	Electrocardiogram findings of			SD
		Syncope index complaint (vs near	QTc>500 mS, pre-excitation,			0 (0.2) vs. 0.03 (0.18)
		syncope)	non-sustained ventricular			Change in syncope functional
		74vs. 61%	tachycardia, Emergency			status
		Congestive heart failure	physician judgment Intermediate Risk Criteria No			-7.6(20.1) vs2.4(26.3)
		2vs. 3%	high risk features AND			Patient satisfaction
		Coronary artery disease	No low risk features AND			8.9(1.40 vs.9.3(0.9)
		13vs.8%	Clinical judgment by			
		Arrhythmia 8vs.6%	emergency physician that patient requires further			
		Syncope in previous yr 16vs.21%	diagnostic evaluation			
		Quality of well-being scale	Low Risk Symptoms			
		0.55(0.15) vs. 0.55(0.14)	consistent with orthostatic or			
		Syncope functional status	vasovagal syncope,			
		29((25) vs.25(26)	Emergency physician judgment that no further			
		Syncope risk score	diagnostic evaluation is			
		0.76 (0.840 vs.0.76 (0.67)	needed.			
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<u> </u>	Author	Study	Participants	Intervention	Control	Outcomes assessed	Results
1	Year Country						
2	Benaiges	cos	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	Mean (SD)
3	Denaiges			Patients assigned to DH if	At hospital discharge, CH	outcomes	DH vs.CH
4	2014	Intervention:	Patients with sustained	admitted to hospital	patients were scheduled	(no distinguishing between	Readmissions for diabetes (%)
5		'Day hospital' (DH)	hyperglycemia (>300 mg/dL) for at	within DH opening hours	for a one-week follow-up	primary and secondary	1(1.6)vs. 5 (13.9)
	Spain	n=64	least 3 days with or without	(week days 8 am -4 pm);	visit in outpatient clinic.	outcomes )	P=0.04
6			ketosis	otherwise they were			Readmission for any cause (%)
7		Control: Conventional		treated in ED and subsequently	Intervention delivered	At 3 mth follow up	4(6.3)vs.7(19.4) p=0.085 No. of outpatient visits (SE?)
8		hospitalisation (CH)	Exclusion criteria	hospitalized.	<b>by:</b> Unclear but normal	[No. of mild or severe	5.0(2.2)vs. 2.5(2.0)
9		n=36	Ketoacidosis (venous pH <7.31	After initial treatment of	outpatient staff	hypoglycemic episodes ]	p=0.012
			and/or HCO3 <22 mEq),	hyperglycemic crisis DH			No. of ER visits (SE?)?
10			hyperosmolar crisis (glycemia >600	patients were scheduled		Readmissions for diabetes	0.2(0.6)vs.0.2(0.4)
11			mg/dL and effective plasma	for follow-up visits at 24,		or unrelated cause	P=0.59
12			osmolarity >320 mOsm/L),	72 hours, and 7 days to		fall and the second second second	Costs
			unstable hemodynamic status or need for ventilatory support,	adjust treatment and to complete their diabetes		[Nosocomial complications	Initial care 580.2(489.1) vs.
13			severe precipitating factors such as	education		1	580.2(489.1) vs. 2,013.6(790.4) p<0.001
14			acute myocardial infarction,			No. of outpatient visits	Complementary examinations
15			stroke, sepsis, social deprivation,	Patients were treated			123.7(276.3) vs. 281.3(188.1)
16			and dependence for four or more	with same protocol for		No. of ER visits	p=0.007
			activities of daily living (Katz index	both DH and CH: this			Pharmacy
17			>D).	included initial evaluation		[outcomes] not detailed as	12.8(95.6)vs. 20.3(24.8)
18				with a blood test, urinalysis, chest		not relevant to our question	P=0.676 Outpatient visits
19			Baseline characteristics of	radiograph to rule out			116.7(75.3) vs. 56.9(105.7)
20			participants	underlying infectious		Costs	p=0.003
			(Stats shown if signif)	disease, and hourly			Readmissions (total)
21			DH vs.CH	measurement of glycemia		Initial care	340.8(1190)vs.288.3(916.8)p=
22			Age	and ketonemia.		Complementary	0.835
23			80.3(4.8)vs. 80.6(4.6)yrs Female	Treatment included hydration as required, an		examinations Pharmacy	Total 1,345.1(793.6) vs.
24			67 vs. 56%	insulin regimen with		Outpatient visits	2,212.4(982.5) p<0.001
			BMI	insulin, and oral		Readmissions	_, (00_10, p 10100_
25			26.1(4.9)vs.25.5(5.1)	carbohydrate intake if		Total	
26			Katz A&B	glucose levels were less			
27			72.2vs.72.2%	than 250 mg/dL with		In euros	
28			Charlson Index	persistent ketosis. If			
			3.2(2.0)vs. 3.3(1.7) Family support	infection was diagnosed, treatment was initiated.			
29			88.1 vs.97.1%	Diabetes education was			
30			Diabetes duration	delivered by specialist			
31			14.4 (8.0) vs. 97.1 yrs	diabetes nurse with			
32			Plus other specific diabetes	specific attention paid to			071
			measures	dietary advice, physical			
33				activity, and recognition of hypoglycemia.			
34				Measurement of glycated			
35				hemoglobin (HbA1c) and			
36				clinical evaluation was			
				scheduled for 3 & 6 mths			
37				for patients in both			
38				groups			I

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Author Year	Study	Participants	Intervention	Control	Outcomes assessed	Results
Country						
Salvi	cos	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	CED vs. GED
54	(secondary analysis)	Patients aged $\geq$ 65yrs were	No details beyond	Patients presenting to	outcomes	Mean duration (SD)
2008	(	enrolled in June 2006 from the	ED plus observation unit of	ED were screened		6.2(4.5) hrs vs. 12.8 (8.5) hrs
	Intervention:	GED and July 2006 from the CED	6 beds	Mon-Fri 9am- 6pm	Mean duration (SD)	P<0.001
Italy	Geriatric ED (GED)	taking care that none presenting		using standard		No. of initial admissions
-	n=100	to the ED in the course of the	Intervention delivered by:	information sheet.	No. of initial admissions	53 vs.63 p=0.2
		study period was recruited again.	No details	Interviews conducted		LOS in days
	Control:			with patients or family	LOS in hospital days	10(6.65) vs. 10.5(7.2) p=0.74
	Conventional ED (CED)	Exclusion criteria		member/other for		No. ED visits
	n=100	Cognitive impairment		patients with cognitive	Both of above presented as	30 days
		(a score of ≥5 on the Short		impairment. Written	baseline data	25 vs. 23 visits p=0.88
)		Portable Mental Status		consent & access to		6months
I		Questionnaire SPMSQ )		medical records was	No. ED visits at 30 days and	51 vs. 42 p=0.25
		and no proxy,		obtained. patients a	6 mths	Frequent ED return (≥3 visits
2		Those too ill to respond, Trauma		underwent a brief		over 6 mths)
3		patients		geriatric assessment	Frequent ED return (≥3	11 vs.13 visits p=0.84
				using the Charlson	visits over 6 mths)	No. hospital admissions at
1		Baseline characteristics of		Index, SPMSQ, and		6mths
5		participants		ADL before the current	No. hospital admissions at	36 vs.29 p=0.2
5		CED vs GED		event	6mths	<b>ADL</b> 20 vs. 20 p=0.34
		Mean(SD)				Mortality
7		Age 78.1(7) vs.82.5(7.20 p<0.001			ADL at 6mths (defined as	30 days 8 vs. 5 deaths
3		Female 47 vs. 68% p<0.001			functional decline	6months 20 vs. 19
-		Married 70 vs. 40% p<0.001				Statistically significant at
		Living alone 12 vs 14			Mortality at 30 days & 6	6mths after adjustment for
)		Triage code			mths	age, sex, living status,
1		Urgent/semi-urgent (2/3) 97 vs.90 %				admission at time of recruitment Charlson index,
					Costs	SPMSQ and ADL
2		Charlson Index 3.3(2.3) vs. 3.4(1.7) SPMSQ			None	p=0.047
3		2.5(3.3) vs. 5.2(4.2) p<0.001			None	μ=0.047
1		ADL4.3(2) vs. 3.2(4.2) p<0.001				
		P=0.001				
5		1-0.001				
6		No differences in profile of				
		diagnosis in ED between groups				
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9						
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 *Community hospital (n=2)* 

Author Year	Study	Participants	Intervention	Control	Outcomes assessed	Results
rear Country						
Garåsen	RCT	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	CH vs. GH No. (%)
		Patients aged ≥60 years admitted	On admission to CH the	The care at different	outcomes	At 26 weeks
2007/8ab	Intervention:	to general hospital due to acute	physicians	departments at GH and		No. of readmission for inde
	Community hospital (CH)	illness or acute exacerbation of	performed a medical	communication with	Follow up at 26 weeks & 12	disease
	n=72 assigned but 8 went	known chronic disease	examination of the patients	primary health care	months	14(19%) vs. 25 (36%) p=0.0
Norway	on to GH		and a	followed the standard		Need for community home
		Probably in need of in ward care	careful evaluation of	routines through the	No. of readmission for	care
	Control:	for ≥ 3-4 days	available earlier health	formal organisation.	index disease	38(53%) vs. 44(63%) p=0.3
	General hospital		records from			Need for long term nursing
	(GH)admission	Admitted from own homes and	the admitting general		Need for community home	home
	n=70	expected to return home when	practitioner, the general		care	7(10%) vs. 5(7%)
		care finished.	hospital physicians and the			p= 0.76
			community home care		Need for long term nursing	No. days in institutions
		Exclusion criteria	services. The		home	31(95% CI 26.1,34.7) vs.29.
		Severe dementia or a psychiatric	communication with each			(95% CI 23.2,36.4) p=0.80
		disorders needing specialised care	patient and his family		No. of days in institutions	No. of deaths
		24 hours a day.	focusing on physical and		after randomisation	9(12.5%) vs14(20%) p=0.15
			mental challenges was also		[intervention +rehab	No. days before death
		Baseline characteristics of	essential to understand the		+readmissions] data is	165 (95% CI 154-176) vs. 1
		participants	needs and level of care.		available for separate	(95% CI 144,165)
		(No stats given)			services	No care
		[including data from	Assume from the inclusion			18(25%) vs. 7(10%) p=0.01
		n=8 who were assigned CH then	criteria that all patients		No. of deaths	12 month data
		went to GH]	came to the general hospital		-	No. of deaths
			initially then		No. of days before death	13(18.1%) vs. 22 (31.4%)
		CH vs.GH				p=0.03
		Age	' When an eligible patient		No care	Total observation period
		80.6 (0.8)vs. 81.3(0.8)yrs	was identified and accepted			335.7(95% CI 312.0,359.4)
		Female	for inclusion, a blinded		12 month data in [0273]	292.8(95%Cl 264.1,321.5)
		72 vs.61%	randomisation was			days p=0.01
		Living with spouse	performed by the			
		16 vs. 15	Clinical Research		Costs	
		ADL (SD)	Department at the Faculty		None	
		2.24(0.9) vs. 2.05 (0.7)	of Medicine.'			
		Primary diagnosis				
		Cardio dis 31 vs.29%	All patients randomised for		•	
		Infect 18vs. 23%	care at the community			
		Fractures/contusions	hospital were transferred			
		19vs. 17%	from the general			
		Pulmonary disease	hospital within 24 hours			
		7vs.9%	after the time of inclusion to			
		Neurological 7 vs.6%	the study and immediately			
		Cancer 3 vs 6%	after the time of			
		Psychiatric 1vs.0%	randomisation.			
		<b>Other</b> 14 vs 11%	1			1
	1	1	1	1		1

Author	Study	Participants	Intervention	Control	Outcomes assessed	Results
Year Country						
Vicente	RCT	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	Intervention vs. control
2014	Intervention:	No specific information	The study was conducted		outcomes	No. of individuals sent direct
	Going to a community-	Exclusion criteria:	over 14 months from Oct	Ambulance personnel		to CH for either to GW or CECC
Sweden	based hospital	No specific information	2008 to Dec 2009. Two EMS	at Company 2 had	Primary outcome:	ITT
	n=410		companies were included in	no training in the	No. of individuals sent	90/449 20% (16.6,24)
	Control:	older adults were randomized	the study. Ambulance	system and tool, and	direct to CH for either to	PP
	Going to ED	when they called the emergency	personnel at Company 1	transported all	GW or CECC	56/273 20.5% (16.1,25.7)
	n=396	number	had training in and access to	individuals to a full-		No. of subsequent transfers
	•	Baseline characteristics of	the system and tool and could triage eligible	service ED at a tertiary hospital	Secondary outcome: No. of subsequent transfers	from CH to ED within 24 hrs ITT 6/90 6.7% (3.1,13.8)
		participants	individuals to a GW or, a	nospital	from CH to ED within 24 hrs	PP 4/56 7.1 (2.8,17.0)
		Intervention vs. control	CECC at a CH. By following			11 4/30 / 11 (2.0,17.0)
			system and tool & after		Calculated as Intention to	
		Mean age (SD)	assessment of the		treat ( ITT) and per protocol	
		81 (8) vs. 81(8) yrs	individual's medical		(pp) analysis	
		% Female	situation and care needs,			
		56 vs. 59%	the ambulance nurse was		Costs	
		Priority level when ambulance	able to decide whether the		None	
		sent out (% individuals) 1. 1.6 vs. 0%	individual required full ED services or would benefit			
		1. 1.8 vs. 0% 2. 59 vs. 47 %	more from being			
		3. 39 vs.53%	transported to an			
		P=0.001	assessment at the CH			
		Priority level when ambulance	instead.			
		arrives at hospital (% individuals)	Delivered by:			
		1. 7.2 vs.3.6%	The ambulance nurse			
		2. 39 vs.35%	education are required to			
		3.54 vs.61%	have a course of 60 credits			
			includes ≥ 30 credits in Caring Science. The criterion			
			for entering this program is			
			a BSc Caring Science and			
			Nursing. Since 2007,			
			a 1-year Master's			
			Degree & postgraduate			
			Diploma in Specialist			
			Nursing, Prehospital			
			Emergency Care Program has been available.		ien,	
			lids been available.			
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Hospital at home for community dwelling older people (n=9)

Author Year Country	Study	Participants	Intervention	Control	Outcomes assessed	Results
Country Patel 2008 Sweden Heart Failure	pilot RCT Intervention: HC Treated at home after >48hrs treatment in ED (n=13) Control: CC Treated in hospital as per hospital treatment guidelines (n=18)	Inclusion criteria: Into study         Earlier diagnosed with CHF with diastolic or systolic LVD         Deterioration of HF ≥3 days with symptoms of increasing dyspnoea, orthopnoea, weight gain≥2 kg, debuting peripheral oedema or abdominal swelling Clinical signs, e.g., extended jugular vein, leg oedema, tachypnoea, pulmonary rales, ascites and third heart sound. At least one symptom and one sign should be present         New York Heart Association class II–IV for home treatment         It was considered medically safe to treat patients at home if they had a S- Potassium level 3.4-5.5 mmol/L, systolic blood pressure >95 mm Hg, S         Creatinine         Creatinine         Zusum level 3.4-5.5 mmol/L, systolic blood pressure >95 mm Hg, S         Creatinine         Unwillingness to participate Worsening of CHF<3 days Newly onset HF, Pulmonary or pre- pulmonary oedema, Need for monitoring of arrhythmia Other morbidities indicating need for hospitalistion. Living at an institution. Inability to follow instructions5- Haemoglobin520 g/L S-Creatinine>250 µmol/L S-Potassium>5.5 µmol/L or 3.4 mmol/L S-Troponin 7>.0.5 µg/L Creatine kinase-MB>5 µg/L ASAT and ALAT>three times above the normal value. Systolic blood pressure>95 mm Hg Heart rate<45 or >110 beats/min Baseline characteristics of participants Male n (%) 6 (46)/7 (54) 15 (83)/3 (17) 0.0.3 Age (years) mean (SD) 77 (10) 78 (8) ns Marital stuts n (%) Divorced 2 (15) 3 (17) ns Single 1 (8) 2 (11) ns Widowed 7 (54) 5 (28) ns Education n (%) 29 years 1 (8) 8 (44) 0.0.2 ns Weight kg mean (SD) 71 (13) 79 (15) ns NT-proBNP g/ml (median and interquartile range) 4420 (1690–14350 9335 (1375–13350) ns LVEF % mean (SD) 36 (13) 33 (12) Preserved ejection fraction CHF n (%) 3 (23) 2 (11) (55) mit 3 (100) 16 (89) NYH	Outline of intervention Initially treated in the ED for 248 h & then sent home. The specialist HF nurses followed a written physician directed care plan including adjusting medications. A cardiologist could be consulted. All patients followed-up one day after returning home by nurse. The patients were visited daily or every other day for S–7 days as appropriate. The home visits stopped when: (1) was symptomatically stable or improving, (2) had stable or falling weight, (3) had no signs of pulmonary rales and (4) had no oedema above the ankle. Patients could contact nurse by phone in office hours. Nurses at intensive cardiac care unit could be reached by telephone after office hours. A cardiologist was always available for phone consultation 51 month after the last home visit, the nurse was available for phone counselling.	Outline of control Treated in hospital as per hospital treatment guidelines	Relevant measures & outcomes No distinction between primary and secondary outcomes Clinical status was documented at 1,4,8& 12 mths Direct costs for control group based on compensation paid to hospital and for home care group based on time & activities of nurses & physicians plus lab tests and i.v diuretic episodes Readmissions from hospital data ( presumably up to 12mths – not listed in methods)	There was no significant difference in clinical events including readmissions adverse events or in HRQL (measured at baseline too). The total cost related to CHF was lower in the HC group after 12 months (p=0.05) detail of costs Euros HC vs. CC Nurse cost 386 (244-1107) v N/A Physician 35(19-74) vs. N/A Transport 96953-127) vs. N/A Transport 96953-127) vs. N/A Transport 96953-127) vs. N/A Transport 96953-127) vs. N/A Cost for care 586 (334-1125) vs. 3277 (2125-5750) Readmissions 0.5(0.8) vs. 0.6 (0.8) ns

1 2 3	Year						
	<b>6 1</b>						
2	Country Mendoza	RCT	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	
	2009	KUI	Patient of 65 years and over	Outline of Intervention	Outline of control	outcomes	Clinical outcomes were similar after initial admission and also
4	Garcia-	Intervention:	With diagnosis and prognosis	Characteristics of the HaH	Patients were admitted	outcomes	after the 12 months of follow-
-	Soleto	Hospital at home (HAH)	evaluation of HF since at least 12	unit explained whilst still in	to hospital, cardiology	No distinction between	up.
5	2013	care (n=37)	months prior to the study	ED. Given information sheet	ward & were managed	primary and secondary	
6		Control:	NYHA functional class II or III	with contact phone	by the usual staff of	outcomes	
7	Spain	Inpatient hospital care	before coming to ED due to	numbers. Within 12–24 h of	cardiology specialists		Death or re-admission due to
		(IHC) in a cardiology unit	exacerbation	the ED visit, patients	and nurses, in	Effectiveness	HF or a cardiovascular event
В		(n=34)	Exclusion criteria	received scheduled & if	accordance with	Necessity to transfer the	occurred in 19 patients in IHC
9	Heart Failure		Admitted in the preceding 2	necessary, urgent visits to	guidelines.	patient from HaH to IHC	and 20 in HaH (P=0.88).
-			months for deterioration of HF or	their homes from an		during the first admission	
10			acute coronary syndrome	internal medicine specialist		Mortality due to any cause,	Changes in functional status
11			Presence of severe symptoms such	& a nurse, (staff of the HaH		re-admission due to HF, or	and health-related quality of
12			as sudden worsening of HF	unit). If deterioration occurred outside the		another cardiovascular	life over the follow-up period
			Poor prognosis factors (haemodynamic instability, severe	working hours (8am-9 pm		event (stroke, acute coronary syndrome, and	were not significantly different.
13			arrhythmia, baseline creatinine	every day of yr), patients &		coronary syndrome, and coronary revascularization)	uncient.
14			above 2.5 mg/dL)	family were instructed to		during 1 year of follow-up.	Average cost
15			No response to treatment in the	call 112 to explain they		Functional status -Barthel	of initial admission
			ED	were HaH patients.		index	4502±2153E in IHC and
16			Active cancer, severe dementia, or	Samples were taken for lab		Health-related quality of life	2541±1334E in HaH (P< 0.001).
17			any other disease at an advanced	tests and ECGs were		-SF-36 since first admission	
18			stage indicating life expectancy of	performed in patient's		up to 12 months later	During 12 months of
			less than 6 months	home			follow-up, the average
19			Acute psychiatric diseases, active				expenditure was 4619+7679E
20			alcoholism	X-ray & echocardiography at		Costs	and 3425+4948E (P= 0.83)
21			Active pulmonary tuberculosis Those living in a psycho-geriatric	hospital was as accessible for HaH patients		Cost of the stay Medication, diagnostic tests	respectively.
			institution	as for in-patients. Generally		(electrocardiography,	
22			No guarantee of all-day	all patients were visited		echocardiography,	
23			supervision	daily by a specialist nurse.		laboratory tests, and chest	
24			Absence of a telephone at home or	Patients were visited by a		X-ray), consumables, and	
			living more than 10 km from the	physician daily or every		transport.	
25			hospital	other day depending on		visits to HF clinic, primary	
26			Baseline characteristics of	condition. Treatment in HaH		care physician or ED, as well	
27			participants IHC vs. HaH	finished with referral to		as re-admissions.	
			Women, n (%) 10 (29.4) 19 (51.4)	primary care after		For re-hospitalizations, the	
28			0.06 Age, mean +SD 79.9+6.3	recovery or, in case of		cost of the admission was	
29			78.1+6.2 0.20 Admissions for HF in previous year 0.41+0.86 0.65+0.86	deterioration or no response to treatment, with		estimated as the average cost per day incurred during	
30			0.13 O2 saturation in ED 91.4+5.2	transfer to the cardiology		the first admission for each	
			93.2+4.6 0.12 Functional Class	ward.		group.	
31			NYHA II, n (%) 23 (67.6) 19 (51.4)			5. oup.	2
32			Functional Class NYHA				
33			III, n (%) 11 (32.4) 18 (48.6) 0.16				
			Atrial fibrillation, n (%) 16 (47) 21				
34			(56.8) 0.49 LVEF ≥45%, n (%) 24				
35			(70) 23 (62.1) LVEF , <45%, n (%)				
36			10 (29.4) 14 (37.8) 0.13 NT-proBNP				
			(pg/mL) 4056+5352 3864+3720				
37			0.86 Charlson index 2.1+1.3				
38L			2.5+1.5 0.35				

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1	Year						
2	Country						
3	Tibaldi	single blind RCT	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	Primary outcomes
	2009		≥75 years with a pre-existing	The team has 7 cars, is	The inpatient control	outcomes	Patient mortality at 6 months
4	Italy	Intervention:	diagnosis of CHF (stage C AHA) &	multidisciplinary and	group (GMW) received	Defense autor and	was 15% in the total sample,
5	Heart Failure	Physician led - Geriatric Home Hospitalization	persistent functional impairment indicative of NYHA class III or IV	consists: 4 geriatricians, 13 nurses, 3 physio-therapists,	routine hospital care. Protocols for	Primary outcome Mortality at 6 months.	without significant differences between the 2 settings of care.
6	Heart Failure	Service (GHHS; n=48)	status presenting at hospital ED	1 social worker &1	prevention of	Secondary outcomes	( 7 vs. 8 deaths )
		Service (01113, 11-46)	for acute decompensation	counselor working together	nosocomial infections,	morbidity (infections,	Secondary outcomes
7		Control:	(defined )& in need of hospital	as a team, with daily	bed	delirium, bed sores,	The number of subsequent
8		Patients were randomly	care. Additional inclusion criteria	meetings	sores, and	deep vein thrombosis, and	hospital admissions
9		assigned to the general	were appropriate care supervision	7 days a week. In ED all	immobilization are	falls) during hospitalization,	was not statistically different
		medical ward (GMW;	at home, telephone connection,	necessary diagnostic	routinely adopted for	admissions to a nursing	in the 2 groups
10		n=53)	living in the hospital at-home	tests are provided and then	frail elderly	home, and subsequent	8 (17%) vs. 18 (34%)
11			catchment area, informed consent,	the patient moves home by	inpatients.	hospital admissions	
12			at least 1 previous admission for	ambulance, usually within a		related to any cause	mean (SD) time to first
			acute CHF, and need for	few hours. Medical			additional admission was
13			intravenous drug infusion.	consultation with other			longer for the GHHS patients
14			Exclusion criteria New-onset heart failure; absence	hospital specialists is possible in the hospital or			(84.3 [22.2] days vs 69.8[36.2] days, <i>P</i> =.02).
15			of family and social support; need	at the home of the patient.			09.8[30.2] uays, r=.02].
			for mechanical ventilation,	Treatments included			Only the GHHS patients
16			hemodialysis, or intensive	physician and nurse visits,			experienced improvements in
17			monitoring; severe dementia;	standard blood tests, pulse			Depression (GDS) +1.48 (1.860
18			terminal malignant neoplasm;	oximetry, spirometry,			vs. +0.12 (3.36) p=0.02)
			severe renal impairment; hepatic	electrocardiography,			nutritional status (MNA) -
19			failure; serum hemoglobin level	echocardiography etc (as			0.86(1.12) vs0.27 (1.78)
20			less than 9 g/dL; and planned	per hospital) Patients			p=0.05
21			cardiac surgery(eg, valve	treated at home and family			Quality-of-life(NHP) +1.09
			replacement). Baseline characteristics of	members obtained adequate Education e.g.			(2.57 vs. +0.18 (1.94) p=0.046
22			participants	early recognition of			
23			Long list of demographic & clinical	symptoms. Protocols for			
24			baseline – truncated	prevention of nosocomial			
			GHHS vs. GMV	infections, bed sores, and	-		
25			Mean age 82.2 (5.2) vs. 80.1(4.9)	immobilization are routinely			
26			p=0.04	adopted for frail elderly			
27			Male (%) 22(46) vs. 30 (57)	inpatients. In the first days			
			Married (%) 22 (46) vs. 24 (45)	after admission to GHHS			
28			Family support at home (%)	patient was visited at home			
29			48(100) vs. 53(100)	on a daily basis by			
30			Length of disease (yr) 5.4 (4.7) vs. 5.2 (4.7) plus clinical symptoms	physicians and nurses. In the following days this care			
			both cardiovascular & general	is tapered off as appropriate			
31			including functional status	Consultation with			
32			(Barthel index) depression (GDS)	cardiologists or other			
33			MMSE, MNA, comorbidity	hospital specialists was			
			measured by CIRS 3.6 (1) vs. 3.4	possible. Physicians and			07/2
34			(2) All ns except age	nurses were available at all			
35				times for urgent home			
36				visits.		1	
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Author	Study	Participants	Intervention	Control	Outcomes assessed	Results
Year						
Country						
Ricauda	Single blind RCT	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	Primary outcomes
		Patients ≥75 yrs with a diagnosis of	Intervention delivered by;	Intervention delivered	outcomes	GHHS vs. GMW
2008	Intervention:	acute exacerbation of COPD,	"a physician-led	by:		Hospital readmissions at6mth
	Geriatric home	defined on Anthonisen criteria as	substitutive hospital-at-	The inpatient control	Primary outcomes	42% vs 87%, P= 0.001
Italy	hospitalization service	an increase in breathlessness,	home model of care"	group received routine	Hospital readmission &	Cumulative mortality at 6 mth
	(GHHS, n=52)	sputum volume, or purulence for		hospital care	mortality rates at 6 months.	was 20.2% in the total sample
COPD		at least 24 hours, admitted to the	Patients assigned to HaH		-	No significant differences
	Control:	ED & requiring hospitalization.	were immediately		Secondary outcomes	between grps.
	General medical ward	Additional inclusion criteria were	transferred home by		Depression status -Geriatric	
	(GMW, n=52)	appropriate care supervision in the	ambulance. At		Depression Scale, functional	Secondary outcomes
		home, telephone connection,	home, a multi-dimensional		status- Katz activities	Mean length of stay
		living in the HaH & informed	geriatric assessment was		of daily living	15.5 ±9.5 vs 11.0 ± 7.9 days, P
		consent.	conducted & patients		& Lawton instrumental	0.010
		Exclusion criteria	received hospital-level		activities of daily	Only GHHS patients
		Absence of family and social	treatment& services, as		living	experienced improvements in
	1	support; severe hypoxemia (partial	their condition dictated.		Cognitive status -Mini-	depression and QoL
		pressure of oxygen <50 mmHg);	(Physician and nursing visits,		Mental State Examination,	scores but ns between grps
		severe acidosis or alkalosis (pH	standard blood tests, pulse		Quality of life -the	There were no differences in
		<7.35 or >7.55); suspected	oximetry,		Nottingham Health	functional, cognitive,
		pulmonary embolism; suspected	electrocardiogram,		Profile	nutritional, or caregiver
		myocardial infarction; severe	spirometry, echocardiogram,		Nutritional status -Mini	burden outcomes.
		comorbid illness as defined by	echographs and Doppler		Nutritional Assessment,	Satisfaction at discharge was
		presence of need for hemodialysis,	ultrasonographs,oral &		Caregiver characteristics -	very good or excellent
		severe renal impairment	intravenous medication		Relatives' Stress Scale, &	for 94% vs. 88% (P=0.83)
		(glomerular filtration rate <20	administration, including		satisfaction using ad hoc	(On a cost per patient per day
		mL/min), cancer (except skin	antimicrobials & cytotoxic		questionnaire for	basis,
		cancer), hepatic failure, or severe	drugs, oxygen therapy,		Scale.	(\$101.4 ± 61.3 vs \$151.7 ±
		dementia (Mini-Mental State	blood products transfusion,		Costs of care were	96.4, P=0.002).
		Examination score <14).	central venous access,		compared for the acute	
		Baseline characteristics of	surgical treatment of		episode.	
		participants	pressure sores, physical			
		Intervention vs. control	therapy & occupational			
		Age, mean ±SD 80.1 ±3.2 79.2 ±	therapy			
		3.1p=0 .20 Male, n (%) 29 (56) 39	The HaH program			
		(75) p=0.06 Married, n (%) 27 (52)	emphasized			
		29 (56) .84 Family support n (%) 52	patient & caregiver			
		(100) 52 (100) p=0.89 Current	education about the			
		smoker, n (%)7(13)6(11) p=0.97Ex-	knowledge of the disease,			
		smoker, n (%) 34 (65) 35 (67)	giving advice about smoking			
		p=0.95 FEV1, mean ±SD 0.92 ±0.4	cessation,			
		1.04 ± 0.5 p=0.18 % of predicted	nutrition, management of			21
		FEV1 38, 47 Home oxygen use,	activities of daily living &			
		n(%)18 (35)12 (23) p=0.45 Arterial blood gas, mean ±SD pH 7.40 ±	energy conservation, understanding & use of			
		$0.04 \ 7.41 \pm 0.03 \ .19 \ PP \ of \ O_2 \ 69 \pm 0.04 \ 7.41 \pm 0.03 \ .19 \ PP \ of \ O_2 \ 69 \pm 0.04 \ O_2 \ O_2$	drugs, health maintenance,			
	1	$1965 \pm 141 \pm 0.03 \cdot 19 \text{ PP of } \text{CO}_2 69 \pm 1965 \pm 14 \text{ .p} = 0.23 \text{ PP of } \text{CO}_2 44 \pm 1965 \pm 14 \text{ .p} = 0.23 \text{ PP of } \text{CO}_2 44 \pm 1965 \pm 1400 \text{ .s}$	& early recognition of			
		$19.65 \pm 14$ .p= 0.23 PP of CO <sub>2</sub> 44 ± 12.46 ± 12 .47 ADL score, mean ±	triggers of exacerbation that			
	1	SD± 2.3 ± 2.2 1.9 ± 2.2 p=0.36 IADL	required medical			
		$SD\pm 2.3 \pm 2.2 \pm 2.2 = 0.36$ IADL score, mean $\pm$ SD 7.1 $\pm$ 4.9 8.1 $\pm$	intervention.			
		4.2 .27 GDS score, mean ± SD 16.1	intervention.			
		4.2 .27 GDS score, mean ± SD 16.1 ± 6.1 17.2 ± 6.8 .45 Comorbidity				
	1	index 2.6 ± 1.5 3.0 ± 1.8 p=0.24				

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_ [	Author	Study	Participants	Intervention	Control	Outcomes assessed	Results
1	Year						
2	Country						
3	Rodriguez-	COS	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	All comparisons ns
	Cerillo	Intervention:	For trial Non-massive pulmonary embolism	No detail	No detail	outcomes	Mean stay length HH vs. CH
4	2009	Home hospitalization (HH)	No contraindications	No detail	No detail	No distinction between	8.9 days (7–14 days), vs. 10.6
5		(n=30)	for treatment with			Primary and secondary	days (6–20 days).
6	Spain	. ,	low MW heparin			outcomes	, , , , , ,
7	-	Control:	Absence of moderate				All patients in study had a
-	non-massive	Conventional	to severe renal failure			Major and minor bleeding	favourable clinical
8	Pulmonary	Hospitalization (CH)	<ul> <li>Haemodynamic</li> </ul>			Re-thrombosis,	course.
9	embolism	(n=31)	stability			Clinical course	
10			<ul> <li>O2 saturation higher</li> </ul>			Unexpected returns to	No major bleeding, re-
			than 92% breathing			hospital Need for hospital	thrombosis, or death occurred.
11			room air			re-admission in the	occurred.
12			<ul> <li>No signs of heart failure</li> </ul>			following 3 months.	One patient on HH
13			No arrhythmia				experienced an abdominal
14			No haemoptysis				wall haematoma in the area
			For HH				of administration of the low
15			<ul> <li>Agreement to</li> </ul>				MW heparin.
16			admission to our HH				One patient
17			unit				admitted to hospital
			<ul> <li>A valid caregiver at</li> </ul>				experienced a haematoma in
18			home     Residence in our				the right arm related
19			<ul> <li>Residence in our health area</li> </ul>				to blood sampling for
20			A condition amenable				laboratory tests.
21			to home management				
			Exclusion criteria				No patient with HH had
22			massive PE, haemodynamic				infectious complications. Three patients admitted to
23			instability, oxygen saturation				hospital were diagnosed of
24			lower than 92% on room air, heart				urinary tract infection.
25			failure, haemoptysis, arrhythmia & contraindication for treatment		-		
			with low MW heparin				No HH patients required
26			Baseline characteristics of				unexpected return to hospital
27			participants				during admission.
28			Age 66.8 (27–91) 66.7 (31–90) n.s				During follow-up, two patients
			Sex (males) 30% 54.8% n.s				required hospital admission,
29			Diagnosed neoplasm 13.3% 9.7%				one in each group. The cause
30			n.s Associated DVT 40% 29% n.s Prior TED 0% 19.3% 0.05				was not related to the
31			Dementia 23.3% 6.4% n.s.				thromboembolic disease.
32			Hypertension 30% 45.1% n.s.				
			Ischaemic heart disease 6.6% 9.6%				
33			n.s. Thrombophilia 3.3% 0% n.s				
34			Recent surgery 3.3% 6.4% n.s				
35			Unilateral involvement 70% 61.3%				
			n.s Bilateral involvement 30%				
36			38.7% n.s Diagnosed by helical CT 26.6% 38.7% n.s				
37			20.070 30.770 11.5		1	Ĺ	1]

Author	Study	Participants	Intervention	Control	Outcomes assessed	Results
Year Country						
Carratala	Open RCT	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	Intervention vs. control
Carratala	open Net	All immunocompetent patients	Outpatients were given oral	Hospitalized patients	outcomes	intervention vs. control
2005	Intervention:	who were at least 18 years of age	levofloxacin	received sequential		
	Outpatient care with oral	and had received a diagnosis of	(500 mg/d), and	intravenous and oral	Primary outcomes	Primary outcome
Spain	levofloxacin therapy or	community acquired	received detailed written	levofloxacin (500 m	% of patients with an overall	Successful outcome was
	hospitalization with	pneumonia in the emergency	information about their	and received detailed	successful outcome at the	achieved in 83.6 vs. 80.7%
	sequential intravenous	department (24 hrs per day, 7 days	pneumonia diagnosis and	written information	end of treatment, according	(absolute difference, 2.9 %
Pneumonia	and oral levofloxacin	per week)	their treatment plan, as well	about their pneumonia	to 7 predefined criteria:	points [95% CI, ±7.1 to 12.9 %
	therapy. (n=110)		as emergency	diagnosis and their	cure of pneumonia (as	points]).
	Control:	Community acquired pneumonia was defined as the presence of a	contact telephone numbers for a nurse or investigator	treatment plan, as well as emergency	defined later), absence of adverse drug reactions,	% patients with adverse drug reactions (9.1% vs. 9.6%),
	Hospitalisation (n=114)	new infiltrate on chest radiography	physician.	contact telephone	absence of medical	Subsequent hospital
	hospitalisation (II-114)	plus at least 1 of the following:	Patients were visited at	numbers for a nurse or	complications during	admissions
		fever (temperature ≥38.0 °C) or	home by a nurse 48 hours	investigator physician	treatment, no need for	(6.3% vs. 7.0%),
		hypothermia (temperature <35.0	after emergency	g/d) Patients assigned	additional visits, no changes	Overall mortality (0.9% vs. 0%
		°C), new cough with or without	department discharge. The	to hospitalization were	in initial treatment with	Medical complications
		sputum production, pleuritic chest	visit included assessment of	seen daily during their	levofloxacin, absence of	(0.9% vs. 2.6%),
		pain, dyspnea, or altered breath	vital signs and	hospital stay by	subsequent hospital	
		sounds on auscultation.	measurement of oxygen saturation by pulse	attending physicians and by at least 1 of the	admission in the 30 days after randomization,	Secondary outcomes All ns
		Exclusion criteria	oximetry. If	investigators. Criteria	and absence of death from	Quality of life
			the nurse thought that a	for early switching	any cause in the 30 days	(9.1% vs. 9.6%)
		Neutropenia, HIV infection,	patient's condition was not	from intravenous	after randomization.	Satisfied with overall care
		transplantation, or splenectomy or who were taking	improving	to oral levofloxacin		(91.2% vs. 79.1%; absolute
		immunosuppressive	(worsening of baseline vital	were a respiratory rate	Secondary outcomes	difference, 12.1% [CI, 1.8 to
		drugs	signs, oxygen saturation, or	of 24	Patients' quality of life &	22.5 % points]).
		C C	both), one of the	breaths/min or less, a	satisfaction	
		Baseline characteristics of	investigators made an additional visit. The nurse	pulse rate of 100 beats/min or less, a		
		participants	was involved only in	temp of 37.8 °C or		
		Male 69 (62.7) 66 (57.9)	outcome assessment.	lower on 2 occasions at		
		Female 41 (37.3) 48 (42.1)	Patients were seen at the	least 8 hours apart,		
		Mean age ± SD, y 67.5 ± 11.8 64.9 ± 13.4	outpatient clinic at days 7	and maintenance of		
		Alcohol consumption $\pm 80$ g/d, n	and 30 after pneumonia	adequate oral intake.		
		(%) 13 (12.4) 7 (6.4)	diagnosis.	Physicians		
		Current tobacco smoking, n (%)‡		were advised to		
		21 (19.8) 24 (21.8)		discharge patients after their clinical		
		Influenza vaccine in current		condition stabilized, in		
		season, n (%)§ 44 (42.7) 49 (46.2)		accordance with		01/2
		Pneumococcal vaccine in the previous 5 yrs, n (%)± 15 (15.6) 13		previously		
		(13.1)		recommended criteria.		
		Comorbid conditions, n (%) 71		Patients were seen at		
		(64.5) 78 (68.4)		the outpatient clinic at		
		Mean oxygen saturation ± SD, %		days 7 and 30 after pneumonia diagnosis.		
		94.5 ± 2.0 94.5 ± 1.8		pricumonia ulagnosis.		
		Multilobar pneumonia, n (%) 8				
		(7.3) 9 (7.9) Biole close = (%) H 55 (50.0) (2				
		Risk class, n (%) II 55 (50.0) 63 (55.3) III 55 (50.0) 51 (44.7)				
		Mean PSI score $\pm$ SD 70.0 $\pm$ 11.6				
		66.9 ± 12.5				

Author	Study	Participants	Intervention	Control	Outcomes assessed	Results
Year Country						
Kalra	RCT	Patients were included within 72	Outline of intervention	Outline of control	Relevant measures &	Mortality and
2005	Intervention: 1)ST (n=152)	hours of stroke onset. The research team was notified by telephone or fax by GPs for	ST Patients were managed on general wards & under care of admitting physicians. All patients were seen by specialist team:	<b>SU</b> Care was provided by a stroke physician	outcomes Primary outcomes	institutionalisation at 1yr were lower on SU vs.ST or DC
UK Stroke	The stroke team involved management on general wards with	patients at home, and by accident and emergency (A&E) services for suspected stroke patients	doctor (specialist registrar grade), a nurse (grade G), a physiotherapist (senior I) and an	supported by a multidisciplinary team with specialist	Death or institutionalisation at 1 year.	Significantly fewer patients on SU died compared with ST
Stroke	0	<b>S</b> <i>j</i> <b>(</b> <i>j</i>	physiotherapist (senior I) and an occupational therapist (senior I) with expertise in stroke management. Patients were assessed by the specialist team, which undertook a diagnostic evaluation and assessment for needs. Ward provided the day- to-day treatment, the team advised on specialist aspects of stroke care. It reviewed progress and treatment of individual patients with ward team & helped in discharge planning and setting up of post discharge services. The team provided counselling, education and support to the family, identified expectations and advised about realistic outcomes in the context of previous morbidity and present deficits. DC Patients were managed in own home by a specialist team consisting of a doctor (specialist registrar), a nurse (G grade) & therapists (senior I grades), with support from district nursing and personal care needs. Patients were under the joint care of the stroke physician and GP. Investigations, including CT scanning, were performed in outpatient s. Therapy was provided by members of the specialist stroke team. Each patient had an individualised integrated care pathway outlining activities and the			The proportion of patients alive without severe disability at 1 year was also significantly higher on SU vs. ST or DC. These differences were present at 3 & 6 mths after stroke. Stroke survivors on SU showed greater improvement on basic activities of daily living compared the other two grps. Achievement of higher levels of function was not influenced by strategy of care. QoL at 3mths was significantly better in SU & DC patients. There was greater dissatisfaction with care with ST vs. SU or DC. Poor outcomewith DC and ST was associated with Barthel Index <5, incontinence and with ST, age >75 years. The total costs of stroke per patient over 12mths were £11,450 for SU, £9527 for ST & £6840 for DC
			objectives of treatment, which was reviewed at weekly multi-disciplinary meetings.			The mean costs per day alive for the SU were significantly less than those for the ST, but no different from DC patients.
						Costs for DC were significantly less than for those managed by the SU or ST.

, Γ	Author	Study	Participants	Intervention	Control	Outcomes assessed	Results
1	Year						
2	Country						
3	Rodriguez-	Prospective controlled	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	A small amount of free fluid
	Cerrillo	study	≥70 years diagnosed with uncomplicated diverticulitis (The	Intervention delivered by;	Intervention delivered by:	outcomes	was present in 38% of patients treated with HaH and 42% of
4	2013	Intervention:	existence of abscess, fistula, bowel	All patients were given	All patients were given	No primary nor secondary	patients in hospital.
5	2015	Patients stayed 24 h in the	obstruction and peritonitis)	Ertapenem after diagnosis.	ertapenem after	outcomes were defined	All patients had a good clinical
6	Spain	Observation Ward within	Patients who were willing to be	Patients in HaH grp stayed	diagnosis &		evolution. None of the
7		ED prior to discharge and	treated at home and had a	24 h in the observation	experienced traditional		patients treated with HaH
	uncomplicate	treatment at home. (n=34)	caregiver 24 h a day were	ward within ED prior to	hospitalisation		needed be transferred to
В	d	Control:	transferred to HaH. The rest of the	discharge.			hospital.
9	diverticulitis	Traditional hospitalization	patients were admitted to	At home, nurses			Mean stay was 9 days in HaH
10		(n=18)	conventional hospitalization.	administrated Ertapenem every day. The physician			vs. 10 days in Hospital. The cost of each patient with
11			Exclusion criteria	conducted 2–3 home visits			diverticulitis treated at home
			Patients with complicated	per week, depending on the			was 1368 euros cheaper than
12			diverticulitis, β-lactam allergy or	patient's clinical course. On			the cost of a patient treated in
13			who required admission to	admission patients were			the hospital (fewer staff and
14			hospital for other pathology	provided with a phone			important reduction of
15			Baseline characteristics of	number to contact the unit if any problem arose.			maintenance costs).
			participants	Intravenous antibiotic was			
16			intervention vs. control	changed to oral therapy			
17				(amoxicillin–			
18			Age 77 (71–90) 79 (71–98)	clavulanate) after 4–6 days			
19			Sex (female) 28 (82.4%) 16 (84.2%)	of treatment until complete			
			Cardiopathy 9 (26.5%) 6 (31.6%) Diabetes mellitus 4 (11.7%) 2	10 days of treatment.			
20			(10.5%)				
21			Chronic renal failure 4 (11.7%) 1				
22			(5.2%)				
23			Neoplasm 1 (2.9%) 1 (5.2%)				
			COPD 1 (2.9%) 1 (5.2%)				
24			Corticosteroids 4 (11.7%) 2 (10.5%) Previous diverticulitis 7 (20.5%) 3				
25			(15.8%)				
26			Abdominal pain 34 (100%) 19				
27			(100%)				
			Fever 9 (26.5%) 6 (31.6%)				
28			Diarrhea 6 (17.6%) 3 (15.8%)				
29			Leucocytosis 7 (20.5%) 3 (15.8%)				
30							
31							
						184	
32							
33							
34							
35							011
36			1	l			I]

### **BMJ Open**

	Author	Study	Participants	Intervention		Control	Outcomes assessed	Results
	Year Country							
-	Leff	Prospective quasi	Inclusion criteria:	The study was conducted in 3	Outline of intervention	Outline of control	Relevant measures &	Intervention vs. control
5		experimental	Community-dwelling persons ≥65	Medicare managed care	&who delivered 1 Nov	1 Nov 1990-	outcomes	
	[3066]	•	yrs old, Lived in catchment area	(Medicare +Choice) plans at 2 sites	2001-30 Sep 2002	30 Sep 2001) Eligible		Mean LoS (SD) days
5			In the opinion of a physician not	and at a Veterans	Patients evaluated	patients identified &	No distinction between	4.9 (9.9) 3.2 (2.5) p =0.004
		2 consecutive 11 month	involved in study, required	Administration medical centre.	by HaH physician either in	followed through usual	primary and secondary	
;	2005	phases	admission to an acute care	Univera Health and Independent	ED or after ambulance	hospital care.	outcomes	Mean time in ED (SD) in hrs
,			hospital for these illnesses:	Health, in Buffalo, New York, are	transfer to home. HaH		Intervention group	6.4(1.8,11.6)SD 1.9 vs.
;	USA	Intervention:	community-acquired pneumonia,	Medicare + Choice plans These 2	nurse met ambulance		comprised all patients	5.5(1.0,21.3) SD3.2
	Plus	Treatment in a hospital-at- home model of care	exacerbation of chronic heart failure or chronic obstructive	plans collaborated to provide hospital- at-home care and made	at patient's home and provided direct one-on-		eligible for hospital-at-home care, irrespective of where	P=0.001 [Leff 2005]
)	Leff 2009	that substitutes for	pulmonary disease, or cellulitis.	up 1 study site (site 1).	one nursing for an initial		they were treated.	
0	[2545]	treatment in an acute care	Required to meet validated criteria	up i study site (site i).	period of $\leq 8$ hrs at site 3		[thus some outcomes are	Changes in ADL and IADL from
1	Frick 2009	hospital. Offered In the 2 <sup>nd</sup>	of medical eligibility for hospital-	The Fallon Health Care System (site	and ≤24 hrs at sites 1 &		NOT useful to us but some	1mth before admission -2
	[0158]	phase of study	at-home care.	2), in Worcester, Massachusetts,	2. followed by		measures are HaH specific]	weeks after intervention
2		n=169	Exclusion criteria	operates a not-for-profit Medicare	intermittent nursing visits			ADL 0.39(3.13) vs0.6(3.09)
3			Most common reasons for medical	+Choice plan, and the Fallon Clinic,	and HaH physician at		Mean LoS (SD) days [Leff	p=0.1
4		Control:	ineligibility were uncorrectable	a for-profit multispecialty physician	least daily. HaH physician		2005]	IADL 0.74(2.86) vs0.70(2.68)
		Described as 'observation	hypoxemia, suspected myocardial	group, provides care on a capitated	was available 24 hours a		Mana time in CD (CD) in the	p=0.007
5		group' in the first phase of study. Eligible patients	ischemia, and presence of an acute illness, other than the target	basis to Medicare + Choice beneficiaries.	day for visits. Nursing and other care components,		Mean time in ED (SD) in hrs	[Leff 2009]
6		were identified and	illness, for which the patient was	beneficialies.	e.g. durable medical			Costs
7		followed through usual	required to be hospitalized.	The Portland, Oregon, Veterans	equipment, oxygen		Sub-analysis of HaH vs. Non-	Within each health system and per condition Mean (SD)
8		hospital care.	Baseline characteristics of	Administration Medical Center (site	therapy were provided		HaH (i.e. different to main	Overall
		n=286	participants at all sites	3) is a quaternary care and teaching	and some services e.g.		report [Leff 2009]	\$5081(4427)vs.\$7480(8113)
9			(Stats shown if signif)	facility.	home radiology, support		Changes in ADL and IADL	p<0.001
0		Aim:	Observation vs. intervention Age		provided by independent		from 1mth before	Pneumonia
1		'to evaluate the safety,	(SD) 77.3 (6.6) vs.77.2(7.0)	A patient requiring admission to the	contractors. Lifeline		admission -2 weeks after	\$5272(6036) vs. \$6761(6451)
		efficacy, clinical and	% female 34 vs. 42%	acute care hospital for a target	devices were provided for		intervention	NS
2		functional outcomes, patient and caregiver	% white 90 vs.86% % in poverty 11 vs.19%	illness was identified in an ED or ambulatory site and his or her	patients living alone. Diagnostic tests ,		Costs	Congestive heart failure
3		satisfaction, and costs of	p=0.027	eligibility status was determined.	IV fluids, IV antimicrobial		Within each health system	\$3310(2118) vs. \$6399(6643) p≤0.001
4		providing acute hospital	% live alone 43 vs.33%	Non-study medical personnel,	agents, etc. and		and per condition [Frick	COPD
		level care in a hospital at	p=0.022	usually ED physicians, made the	oxygen/respiratory		2009]	\$4293(3806) vs. \$6500(7305)
5		home that substituted	Mean mini mental state (SD)25.5	decision to hospitalize the patient.	therapies were provided			p≤0.05
6		entirely for admission to	(4.2) vs. 25.2(4.4)	All patients who were offered but	at home.		Overall summary	Cellulitis
7		an acute care hospital for	Mean Charlson score (SD)	who declined hospital-at-home	Patient was followed by		'The HaH care model is	\$4262(2309) vs. \$7287(11471)
		older persons.'	3.1 (2.0) vs.3.0 (1.8)	care were admitted to the acute	same physician until		feasible, safe, and	NS
8		Setting: Intervention (if received):	Mean medications (SD) 6.8 (3.9) vs. 8.1(4.5) p=0.002	care hospital. Study coordinators verified the	discharged to primary care		efficacious for certain older patients with selected acute	[Frick 2009]
9		At home	%Primary admission diagnosis	patient's eligibility for HaH using a	to primary care		medical illnesses who	
0		Control	Pneumonia 31vs. 32%	standard protocol at enrolment.			require acute hospital-level	
1		Secondary hospital care	COPD 32 vs.28%	Most patients were identified the			care.' Leff 2005	
			Cellulitis 12 vs 18%	morning after admission.			HaH care is associated with	
2		Power calculation:	CHF 25vs.22%				modestly better	
3		No					improvements in IADL	
4							status and trends toward	
							more improvement in ADL status than traditional acute	
5							hospital care. Leff 2009	
6							Total costs seem to be	
7							lower when substitutive	
							HaH care is available for	
8							patients with CHF or COPD	
9							disease.Frick2009	

### Hospital in Nursing/Care Home (HNCH) (n=2)

asi experimental' ntrolled (his) study ] ervention: pital in the nursing te (HINH) n=62 trol: al in-hospital care .15	Inclusion criteria: Reside in an ACF. Have a signed GP request for HINH review from the ACF. Be of any age (usually2 65 yrs). Present with an illness that required hospital services but not necessarily admission e.g. UTI & could have treatment e.g. antibiotics continued by ACF staff. Prior to start of HINH, patients	In the ED. Enrolments were made by HINH programme manager (registered nurse) with programme director ( ED director), GPs and ACF nursing staff, as appropriate. After hours and on weekends, if patient was suitable for HINH, they stayed in ED short stay unit and were reviewed by HINH nurse on next weekday.	Outline of control The comparison group was selected from patients who presented to ED and were subsequently admitted during the same time period. To be included in	Relevant measures & outcomes Hospital LOS (days) ED LOS (hours)	HINH vs. Control Mean (SD) Hospital LOS 2.19 (0.82) vs.6.2(0.59) days p<0.001
ntrolled (his) study] ervention: pital in the nursing ne (HINH) n=62 trol: al in-hospital care	Reside in an ACF. Have a signed GP request for HINH review from the ACF. Be of any age (usually≥ 65 yrs). Present with an illness that required hospital services but not necessarily admission e.g. UTI & could have treatment e.g. antibiotics continued by ACF staff.	by HINH programme manager (registered nurse) with programme director (ED director), GPs and ACF nursing staff, as appropriate. After hours and on weekends, if patient was suitable for HINH, they stayed in ED short stay unit and were reviewed by HINH nurse on	The comparison group was selected from patients who presented to ED and were subsequently admitted during the same time	outcomes Hospital LOS (days) ED LOS (hours)	Mean (SD) <i>Hospital LOS</i> 2.19 (0.82) vs.6.2(0.59) days
	who would have fit inclusion criteria for hospital admission <b>Exclusion criteria:</b> ACF residents who required extensive treatment that could not be managed in ACF or who required specific services that could only be received in hospital out out the specific services in the spital	Outline of intervention The HINH nurse checks with the ACF registered nurse and patient on the patients' progress initially on a daily basis and then every couple of days. Discharge occurs when required treatment has ceased. This completes the patients' hospital-	this group, the patients had to reside in an ACF and be aged ≥65yrs. ACF residents who presented to the ED were in some cases not enrolled in HINH because they had a medical problem that was judged as possibly requiring in- hospital admission	Episode of care (total time) LOS (days) Long (26days) vs. short hospital LOS Long (28 days) ED LOS vs. short Long episode of care (26 days)	ED LOS 9.94(0.66) vs. 7.01(0.47) hrs p=0.005 Episode of Care LOS 9.56(1.26)vs. 6.20(0.59) day: p=0.14 Percentages Hospital LOS 6+days 9.6 vs. 40 p<0.001 Episode of care 6+days 46 & vs. 40 0, p=0.25
	e.g. surgery Baseline characteristics of participants HINH vs. Control Age (SD) 85(7.1) vs.84.6(6.6)years Triage category 3.2 (0.7) vs.3.2(0.7) Female 76vs. 75% Diagnostic category: Respiratory 24 vs.26% Cellulitis 18 vs.17% Kidney/urinary tract 18vs.16% Cardiac 10 vs. 10 % Abdominal/GI 8vs.8% Viral/sepsis 7 vs.6% All other 16 vs.17%	affiliated episode. Intervention delivered by: HINH programme delivers acute care nursing support services, medication and equipment to the ACF registered nurse and/or enrolled nurse. These services may include initial training and education regarding antibiotic or IV fluid administration; specific wound treatment and dressing procedure (with dressing materials); suprapubic catheter care, behaviour management and palliative care.	services beyond those offered by the HINH. Intervention delivered by: No details but presumably usual hospital staff	Hospital readmissions within 28 days Costs None	46.8 vs.40.0 p=0.35 LOS in ED 8+ hours 50.0vs.33.9 p=0.05 Readmission in 28 days 11.3 vs. 11.3 p=0.99
		required specific services that could only be received in hospital e.g. surgery Baseline characteristics of participants HINH vs. Control Age (SD) 85(7.1) vs.84.6(6.6)years Triage category 3.2 (0.7) vs.3.2(0.7) Female 76vs. 75% Diagnostic category: Respiratory 24 vs.26% Cellulitis 18 vs.17% Kidney/urinary tract 18vs.16% Cardiac 10 vs. 10 % Abdominal/GI 8vs.8% Viral/sepsis 7 vs.6%	required specific services that could only be received in hospital e.g. surgery Baseline characteristics of participants HINH vs. Control Age (SD) 85(7.1) vs.84.6(6.6)years Triage category 3.2 (0.7) vs.3.2(0.7) Female 76vs. 75% Diagnostic category: Respiratory 24 vs.26% Cellulitis 18 vs.17% Kidney/urinary tract 18vs.16% Cardiac 10 vs. 10 % Abdominal/GI 8vs.8% Viral/sepsis 7 vs.6% All other 16 vs.17%	required specific services that could only be received in hospital e.g. surgeryrequired treatment has ceased. This completes the patients' hospital- affiliated episode.possibly requiring in- hospital admission services beyond those offered by the HINH.Baseline characteristics of participants HINH vs. Control Age (SD) 85(7.1) vs.84.6(6.6)years Triage category 3.2 (0.7) vs.3.2(0.7) Female 76vs. 75% Diagnostic category: Respiratory 24 vs.26% Cellulitis 18 vs.17% Cellulitis 18 vs.17% Cardiac 10 vs. 10 % Abdominal/GI 8vs.8% Viral/sepsity 57 vs.6% All other 16 vs.17%Intervention delivered by: HINH programme delivers acute care nursing support services, medication and equipment to the ACF registered nurse and/or enrolled nurse. These services may initial training and education regarding antibiotic or IV fluid administration; specific wound treatment and dressing procedure (with dressing materials); Suprapubic catheter care, All other 16 vs.17%Intervention delivered by: No details but presumably usual hospital staff	required specific services that could only be received in hospital e.g. surgeryrequired treatment has ceased. This completes the patients' hospital- affiliated episode.possibly requiring in- hospital admission services beyond those offered by the HINH.days)Baseline characteristics of participants HINH vs. Control Age (SD) 85(7.1) vs.84.6(6.6)years Trage category 3.2 (0.7) vs.3.2(0.7) Female 76vs. 75% Diagnostic category: Respiratory 24 vs.26% Cellulitis 18 vs.17% Kidney/urinary tract 18vs.16% Cardia: 10 vs. 10 % Viral/sepsis 7 vs.6% All other 16 vs.17%Intervention delivered by: HINH programme delivers acute care nursing support services, medication and equipment to the ACF registered nurse and/or enrolled nurse. These services may include initial training and education regarding antibiotic or IV fluid administration; specific wound treatment and dressing procedure (with dressing materials); suprapubic catheter care, behaviour management andmospital admission services beyond those offered by the HINH.HINH vs. Control Age (SD) 85(7.1) vs.6% (with dressing materials); Suprapubic catheter care, behaviour management andIntervention delivered by: No details but presumably usual hospital staffCosts NoneNo details 10 vs. 10 % All other 16 vs.17%requiring antibiotic or IV fluid admistration; specific wound treatment and dressing procedure (with dressing materials); suprapubic catheter care, behaviour management andpossibly requiring in- hospital admission services beyond those offered by the HINH.

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### BMJ Open

County         Industry         Industry         Controlled (hip) (Cose wrises         Industry constri- training wrises         Relevant metaury & Bar- Constring         Relevant meta	<b>ا</b> ۲	Author	Study	Participants	Intervention	Control	Outcomes assessed	Results
Lu         Controller (Nic) Case series         Industor criteria: Transmittion (Nic) participation (CaseCity within HT to accept the series caseCity within HT to accept the meets of the particip in the critical age: case failing meets of the participation (Nic) partitipati (Nic) participati (Nic) participation (Nic) partic	1	Year						
3         series         Patient and/or family consent intervention Fraction intervention fraction interventintervention interventinterventio			Controlled (his) Case	Inclusion criteria:	In the ED the acuity of presenting	Outline of control	Relevant measures &	TRC vs. ACU
S         Australia         Intervention Treatment in residential care indicises (KG) gra- n=56         Pailination in residential care indicises (KG) gra- s=1134         Pailination in residential care indicises (KG) gra- s=1134         Pailination in residential care indicises (KG) gra- gra- gra- gra- gra- gra- gra- gra-	3							Palliative care
5     Australia     in residential are facilities (firsg en n=55     Fieldity able to manage the care mediantial aged rank facilities (firsg en m=55     who presented atter hours were mediantial aged rank facilities (firsg en m=55     in training en mediantial aged rank facilities (firsg en mediantial facilities (firsg en mediantiantia) facilities (firsg e	4	2013			1 / 5			34 (35.8%) 13 (7.8%) <0.001
6     Locate     Technical     Technical     Technical     Technical     Technical     Poilt 350 that stay unagenet.     Poilt 350 that stay unagenet.<	5	Australia		•	0, 1	•	Palliative care	, ,
7     n=95     residential agade are facility (RACF)     ED for assessment. TITE generally parter.     ACU is assessment. TITE generally parter.     Control     Genotith mortality (RACF)     Control       10     Control     Exclusion entrinis and/or family.     Exclusion entrinis and/or family.     The parter and parter.     Control     Control     The parter and parter.     Control     The parter and parter parter and parter parter and parter and		Australia				, ,	Mortality on discharge	
8     control     (NOC)     (NOC) <t< td=""><td></td><td></td><td>1 /01</td><td></td><td></td><td>,</td><td></td><td>•</td></t<>			1 /01			,		•
9     Hospital-based aged (are unit (ACU) n=167     Echusion fettrain: and/or family. Baseline daracteristis of the ageressive between out of the ageres the ageressive between out of the ageressive between out o				(RACF)			6-month mortality	
9     care unit (ACU) n=367     Lack of consent from patient and/or framity. Behavioural disturbances, which behavioural disturbances, which for TRC     would use dimical judgement to for TRC     care facilities for the macking mane for the patient was subable for TRC     month     month       11     additional functional patient ace, aggressive behaviour and fequent removal of Patient in Residential Care detec.     Cultine of Intervention facilities (TRC) delivered by the facilities (TRC) delivered by facilities (TRC) delivered by facilit				Evolution critoria	•	•	Babaanitalization within 1	
11       and/or family.       determine if a patient was suitable       management of general       Total hospitalization of months         12       e.g. aggressibe behaviour alist diversion of the experimentation of the experimentatin the experimation of thexperimation of the experiment	-				0		•	
12may prevent the delivery of are in the equate removal of V, access delivery of are in the Redictinal Care Intervention frequent removal of V, access delivery of are in the Redicting Care Intervention adjusted by: Noteballs but presumably usual hospital staffmonths mants (Larght of star) Larght of star) Larght of star)months months Larght of star) Larght of star) Larght of star) Larght of star)months monthsmonths months Larght of star) Larght of star)14device. History of recent fails, which may management, further input and discussion were carried out in ACU.Appropriate Clinical Diagnosis care support.Intervention delivered by: Noteballs but presumably usual hospital staffAll messared as' present or not'Months Larght of star)20Baseline characteristics of startificiantsAppropriate Clinical Diagnosis care support.Costs NoneNone21TRC vs. ACU Age 835 vs.850; Monther appropriate Startificiant support.Treatment can therefore include any of the following: Dragen therapy (low flow) Charbon scoreTreatment and therapy (low flow) Charbon scoreNoneCosts None23TRC vs. ACU Age 835 vs.850; PO.0001 Charbon scoreTreatment and therapy (low flow) days appropriate support programsTreatment and therapy (low flow) daysTreatment and therapy (low flow) days24TRC vs. ACU Age 835 vs.85, PO.0001 Charbon scoreTreatment and therapy (low flow) daysTreatment and therapy (low flow) daysTreatment and therapy (low flow) daysTreatment and therapy (low flow) days25Treatment and t	10			·	, .			20 (21.1%) 35 (21.0%) p=0.986
12     e.g. agressive behaviour and request request removal of V, access device.     Outline of intervention delivered br: Treatment in Residential Care facilities (TRC) delivered br: No details but magement, further input and discussion were carried out in ACU.     Intervention delivered br: No details but magement, further input and discussion were carried out in ACU.     Intervention delivered br: No details but magement, further input and discussion were carried out in ACU.     Appropriate Clinical Dagnosis Dehydraton, fireumoia, forminat discussion were carried out in ACU.     Appropriate Clinical Dagnosis Dehydraton, fireumoia, forminat discussion were carried out in ACU.     Costs     Costs       20     Baseline characteristics of participants     management, further input and discussion were carried out in ACU.     Treatment in herefore indude any of the following; Treatment in therefore indude and management, could not be support in the despite and and the antipate and in the participants are any of the following; Treatment in sectore indude and management, could not be support in the despite and and the antipate and in therefore indude any any of the following; Treatment in sectore indude and management	11				for TRC	medical conditions.	-	Total re-hospitalization at 6
13 14 14 14 14frequent removal of IV, access device.Treatment in Residential CareDreadential CareDr					Outline of intervention	Intervention delivered	months	
14device. History of recent fails, which may impact on the delivery of are in the RACF.Facilities (TRG delivered by the Residential care intervention Program into the Eldery (RECPE) service between July Oct 2008.All measured as 'present of not'Mean (no 50 given ) Zxs.13 days PC.0001 Equivalent of 270 vs. 1840 bed days16if there was conflict regarding management, further input and discussion were carried out in ACU.Appropriate Clinical Diagnosis Delydration, Peruomain, Ostarcentettis, Deey Venous Thrombosis, Terminal care support.CostsCosts20Baseline characteristics of participantsTreat Interior, Gastroentettis, Deey Venous Thrombosis, Terminal care support.CostsNone21Treat. Naciona, Gastroentettis, Deey Venous Thrombosis, Terminal care support.CostsNone23Age 83.5 vs.82.8yrs High level of nursing homecare 7.1 SD 1.9 vs.7.2 SD 2.3Treat. Intervention Palitative support' Referral to ther appropriate support programsNone267.1 SD 1.9 vs.7.2 SD 2.3' [TRC also offered palitative care as appropriate. Litervention Palitative as green, followed by palitative care in a support programs' [TRC also offered palitative care as appropriate. Litervention delivered by: Certatrian, registrian and nursing saft with access to alled health saft with access to alled health 							Length of hospital care/stay	
15     impact on the delivery of care in the RACF.     Program into the Edelvery (RECIPF) service between uiv-0 cases.     hospital staff     not"     Prod.001       17     if there was conflict regarding management, further input and discussion were carried out in ACU.     Appropriate (Inical Diagnosis Dehydration, Reumonia, Urinary Tract Infection, Gastroenrisb, Deep Venous Thrombosis, Terminal care support.     Costs     None       20     Baseline characteristics of participants     Treatment can therefore initial any of the following:     None     Costs       21     TRC vs. ACU Age 33. vs.82. Byrs Female 53. vs.85% Via nationaria     Treatment can therefore initial any of the following:     Treatment can therefore initial any of the following:     Costs       23     Female 53. vs.85% Via nationaria     Program into the Edelwern uiv-of the following:     Treatment can therefore initial any of the following:     Treatment can therefore initial any of the following:     Costs       24     Yu x.5%     Program into the Edelwern uiv-of the support*     Referral to other appropriate support programs     Treatment can therefore initial any of the following:     Freate 51. vs.6%       29     7.1 SD 1.9 vs. 7.2 SD 2.3     * TRC cass on offered pallative care as appropriate. If patient's condition charged and management could not be continued, transfer into acute hospital was organized. If patients the durent an programs     Intervention delivered by: Geräfitikan, registra and ursing staff with as physiotherapy, QT, speech pathology and social work.     Intervention delivered by: Speech pathology a						•		Mean ( no SD given ) 2vs.11
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37       Geriatrician, registrar and nursing         38       staff with access to allied health         39       speech pathology and social work.					Oxygen therapy (low flow)			
37       Geriatrician, registrar and nursing         38       staff with access to allied health         39       speech pathology and social work.					Appropriate Allied Health			
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37       Geriatrician, registrar and nursing         38       staff with access to allied health         39       speech pathology and social work.	27				support programs			
37       Geriatrician, registrar and nursing         38       staff with access to allied health         39       speech pathology and social work.	28							
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### A systematic review to identify and assess the effectiveness of alternatives for people over the age of 65 who are at risk of potentially avoidable hospital admission.

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people over the age of 65 who are at risk of potentially avoidable hospital admission.

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### ABSTRACT

### **Background / objectives**

There are some older patients who are 'at the decision margin' of admission. This systematic review sought to explore this issue with the following objective: What admission alternatives are there for older patients and are they safe, effective and cost-effective? A secondary objective was to identify the characteristics of those older patients for whom the decision to admit to hospital may be unclear.

### Design

Systematic review of controlled studies (April 2005-December 2016). The protocol is registered at PROSPERO (CRD42015020371). Studies were assessed using the Cochrane risk of bias criteria, and relevant reviews were assessed with the AMSTAR tool. The results are presented narratively and discussed.

### Setting

Primary and secondary health care interface.

### Participants

People aged over 65 years at risk of an unplanned admission.

### Interventions

Any community-based intervention offered as an alternative to admission to an acute

### hospital

### Primary and secondary outcomes measures

Reduction in secondary care use, patient-related outcomes, safety and costs.

### Results

Nineteen studies and 7 systematic reviews were identified. These recruited patients

with both specific conditions and mixed chronic and acute conditions. The

interventions involved paramedic/emergency care practitioners (n=3), emergency

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department-based interventions (n=3), community hospitals (n=2), and hospital-athome services (n=11). Data suggest that alternatives to admission appear safe with potential to reduce secondary care use and length of time receiving care. There is a lack of patient-related outcomes and cost data. The important features of older patients for whom the decision to admit is uncertain are: age over 75 years, co/multimorbidities, dementia, home situation, social support and individual coping abilities.

### Conclusions

This systematic review describes and assesses evidence on alternatives to acute ι han . care for older patients and shows that many of the options available are safe and appear to reduce resource use. However, cost analyses and patient preference data are lacking.

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#### STRENGTHS AND LIMITATIONS OF THIS REVIEW

- 1. High quality systematic review of controlled studies.
- 2. Specific focus on admission avoidance interventions for acute care of older people.
- 3. Studies cover a wide range of acute conditions and acute exacerbation of chronic conditions in older people.
- 4. Some of the studies are pragmatic in approach and are at high risk of bias.
- 5. Most studies do not provide associated costs/cost analyses of interventions or patient preference data.

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#### Introduction

Reducing emergency bed days is one of the biggest challenges currently facing the National Health Service (NHS) in the United Kingdom (UK) and there is considerable pressure to reduce hospital admissions amongst older people throughout the developed world.<sup>1</sup> It has been suggested that clinicians should: 'choose to admit only those frail older people who have evidence of underlying life-threatening illness or need for surgery'.<sup>2</sup> In the UK there has been a 65% increase in hospital admissions for those over 75 years of age in the last decade. Furthermore, people over 85 years of age now account for 11% of emergency admissions and 25% of critical care bed days.<sup>3</sup> The international literature indicates that decisions to admit to an acute hospital are often influenced by inadequate knowledge of the patient or condition, communication difficulties between primary and secondary care, presence of co-morbidities, availability of test results, perceived benefits of in-patient care and patient preferences.<sup>4</sup> A review by NHS England highlighted the need to identify those frail and elderly people who need care but do not have a medical need requiring hospital admission.<sup>3</sup> It is clear that there are some older patients for whom care in the community is safe, perhaps with provision of additional services, and some for whom admission is required to deliver diagnostics or treatment that are only available in hospital. However, for those patients 'at the decision margin', the best path of action may be unclear.<sup>5</sup> The decision may be affected by non-clinical and clinical factors e.g. multi-morbidity, how much risk the patient or family are willing to accept.

Our specific objective was to conduct a systematic review to identify studies of community-based interventions aimed at reducing secondary care use in older patients with acute medical problems potentially requiring unscheduled hospital

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admission. A secondary objective was to further confirm the characteristics of those older patients for whom the decision to admit to hospital may be unclear.

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#### Methods

#### Protocol and registration

The protocol for the systematic review was registered at the PROSPERO register on 14/06/2015. Registration number is: CRD42015020371 (Supplementary material)

#### Eligibility criteria

Publications of any randomised or non-randomised controlled trial (RCT or nRCT) which fitted our PICO criteria: a **P**opulation aged over 65 years, of either sex living in Organisation for Economic Co-operation and Development countries being considered for an unplanned admission, receiving either an Intervention considered to be an alternative to acute hospital admission or acute hospital admission (**C**ontrol). The studies needed to record at least one of the following as either a primary or secondary **O**utcome: intervention effectiveness in terms of patient's subsequent ED attendance or readmission, patient-related outcomes, safety or healthcare costs.

#### Information sources and searches

Medline, Medline In-Process, Embase, Cinahl and CENTRAL databases were searched from January 2005-April 2015 inclusive using search terms based on the eligibility criteria. (Appendix 1) An update was run in December 2016 across Medline and Medline In-Process. We included any relevant systematic reviews published 2010- 2016. The decision to time limit the searches was based on the fact that the systematic reviews would cover any older studies and that any evidence not included in these two sources was unlikely to be relevant to the fast changing

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primary and secondary health care interface. The King's Fund and Agency for Healthcare Research and Quality websites were also searched in April 2015.<sup>6,7</sup> References were managed using EndNote X6 software and were screened by title and abstract followed by full text, both independently and in duplicate (AH, BD), using predefined inclusion/exclusion criteria. Any disagreements in either stage were resolved using a third reviewer (SP). The reference lists of included studies were checked and forward referencing was conducted using Google Scholar. Authors of included studies were contacted for details of any extra studies.

#### Data items and collection process

Data from all primary studies (2005-2016) were extracted into a custom-designed table. The main results and conclusions of recent high quality systematic reviews (2010-2016) which included relevant primary studies were also recorded.

#### Assessment of risk of bias of individual studies (Appendix 2)

The Effective Practice and Organisation of Care Cochrane risk of bias tool was used to critically appraise RCTs and nRCTs.<sup>8</sup>

#### Assessment of methodological quality of systematic reviews (AMSTAR)

#### (Appendix 3)

The AMSTAR checklist was used to assess the quality of the included systematic reviews.<sup>9</sup>

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#### Synthesis of results

The data are presented narratively describing, if present, the most relevant systematic review and/or individual studies for each intervention and, where appropriate, for a specific condition.

In order to identify the characteristics of those older patients for whom the decision to admit to hospital may be unclear, the inclusion/exclusion criteria and demographics of the participants were examined and key features were tabulated alongside the number and references of relevant studies.

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Summary Table: RCT/nRCT and systematic evidence for alternative to admissions for the older population

Intervention/ setting	Paramedic/ emergency care practitioner	Emergency department	Community hospital	Hospital at home Heart Failure	Hospital at home COPD	Hospital at home Pulmonary embolism	Hospital at home Pneumonia	Hospital at home Stroke	Hospital at home Uncomplicated diverticulitis	Hospital at home Older population with acute medical problems
Primary studies identified 19 studies over 24 papers n=10 RCT, n=9 nRCT	n=3 (RCT & 2 nRCT) Mason 2007 Gray 2008 Mason 2012	n=3 (RCT & 2 nRCT) Sun 2014 Benaiges 2014 Salvi 2008	n=2 RCT Vicente 2014 Garåsen 2007, 2008ab	n=3 RCT Mendoza 2009/García- Soleto 2013 Tibaldi 2009 Patel 2008	n=1 RCT Ricauda 2008	n=1 nRCT Rodriguez-Cerillo 2009	n=1 RCT Carratala 2005	n=1 RCT (3 arm) Kalra 2005	n=1 nRCT Rodriguez-Cerrillo 2013	n=3 nRCT Leff 2005/2009/Frick 2009 Crilly 2011 Lau 2013
Main conclusions of primary studies Statistically significant differences between alternative care and acute hospital care	Mason RCT Reduction: Risk of ED attendance, Risk of hospital readmission. Increase: Satisfaction with care Mean duration of care Subsequent unplanned contacts with secondary care Comparable: Mortality Two nRCTs report greater reduction in admissions No cost data	Sun RCT Reduction: Time of episode of Care Less likely to be admitted into hospital Costs Comparable: Serious events QoL Satisfaction with care ************************************	Vincente Data limited. Neither formal analyses nor cost data presented. Garåsen Reduction: Hospital readmissions Receiving any care at 26 wks Deaths Total costs & mean costs per patient Increase: Observation period	Meta-analysis in systematic review	Reduction: Readmissions Mean cost per patient Increase: Length of stay. Comparable: Depression QoL Mortality	Comparable: Mean length of stay No major bleeding, thrombosis or death in either group No cost data	Increase: Patients were satisfied with care Comparable: An overall 'successful outcome' Readmissions QoL Adverse drug reactions Medical complications Mortality No cost data	Increase: Mortality & institutionalisation Reduction: QoL scores basic activities of daily living Costs were lower for HaH group but eclipsed by poorer patient outcomes.	Limited data. Reduction: Cost reduction of €1368 per patient. Comparable: Mean length of stay	Leff Reduction: Length of stay Mean treatment cost Comparable: Use of health services ED visits or readmission Crilly Increase: Longer time in ED Comparable: No mortality or cost data Comparable: Mortality Readmissions No cost data
Systematic review identified	NO	NO	NO	Quaddoura 2015	Jeppesen 2012	Vinson 2012	Chalmers 2011	Shepperd 2016 Chalmers 2011	Varney 2014	NO
Description of, and main conclusions of systematic review				3 RCTs as above used in meta- analysis Increase: Time to first readmission HQoL at 6 &12 mths Reduction: Costs for index treatment Comparable: Rate of readmission All-cause mortality	8 RCTs 7 did not fit inclusion criteria plus RCT detailed above. <b>Review summary:</b> Selected COPD patients can be safely & successfully treated at home. Favourable readmission rates. A trend towards reduced mortality rate	7 observation studies plus one nRCT detailed above. <b>Review summary:</b> Data are limited, but evidence supports the feasibility & safety of for carefully selected low risk patients.	S studies comprising variety of designs plus one RCT detailed above <b>Review summary:</b> Interventions appear safe. Comparable for mortality, hospital readmissions patient satisfaction. Insufficient data for quality of life or return to usual activities.	Two previous systematic reviews on a mixture of conditions including one RCT described above	Integrative review on admission-avoidance HaH services and included one nRCT described above	

#### Results

The systematic review identified four types of intervention from across 19 studies published in 24 papers: paramedic/emergency care practitioners (n=3), emergency department (ED) interventions (n=3), community hospitals (n=2), hospital-at-home services (n=11).<sup>10-33</sup> (PRISMA diagram) (Appendix 4) Ten of the included studies were RCTs and nine were nRCTs. (Summary table) Fifteen studies were conducted in western European countries of which four were in the UK. Two studies were conducted in Australia and two studies in the United States (US). Risk of bias, general intervention description, AMSTAR and study data are detailed in the appendices. (Appendix 1) (Appendix 2)(Appendix 3) (Appendix 4)(Appendix 5) There was an obvious divide between risk of bias of RCTs and nRCTs with the RCTs generally at low risk for most domains although for some domains there was insufficient information to be make a judgement (Appendix 2). The nRCTs were at high risk from not being randomised and in some studies there was a suggestion of health professional choice in allocation and as, with the RCTs, information was sometimes lacking. Risk of bias of individual studies is detailed below in the relevant section.

The AMSTAR ratings of the systematic reviews was generally good although some reviews did not list details of excluded studies, included studies of high risk of bias and did not perform publication bias analysis. (Appendix 3)

## Paramedic practitioner/emergency care practitioner (PP/ECP) interventions (Appendix 4)

Three studies were identified <sup>10-12</sup> and no relevant recent systematic reviews.

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A cluster RCT (Mason 2007), compared PPs with additional training (n=1469) with standard PPs (n=1549) in assessing and treating elderly people following 999 calls with the aim of measuring subsequent emergency care.<sup>10</sup> Similarly, two more recent nRCT investigated the role of ECPs in avoiding ED) attendance/admissions in elderly populations.<sup>11, 12</sup> Gray 2008 was a case-series study of ECP attendances for elderly patients aged over 65 years with a fall (n=233) compared with historical controls (n=772), and Mason 2012 was a cluster controlled study of enhanced ECP care for five care homes (n=256) compared with standard care in five other care homes (n=201). Risk of bias was low for all the domains of the cluster RCT and both of the nRCT were at high risk due to lack of randomisation.

In the cluster RCT, all primary outcomes comparing the intervention with the control group were improved: relative risk of ED attendance within 28 days (RR 0.72 (0.68, 0.75)), relative risk of hospital admission within 28 days (RR 0.87 (0.81, 0.94)), being very satisfied with care (RR 1.16 (1.09, 1.23)) and mean total episode duration in hours (-42.2 (-59.5,-25.0)) with a reported p<0.001 for all.<sup>10</sup> The secondary outcome of mortality was comparable between groups, but intervention patients had a greater number of subsequent unplanned contacts with secondary care at 28 days (330 vs. 259 p<0.01).

The two nRCTs reported a greater reduction in admissions when comparing the intervention with normal ECP practice but these results are of limited use due to the high risk of bias of the studies.<sup>11, 12</sup>

None of the studies of PP/ECP interventions provided details of cost data or costeffectiveness analysis.

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#### Emergency department (ED) interventions (Appendix 4)

The searches identified one RCT (Sun 2014) which was assessed to be at low risk of bias, and two nRCT (Benaiges 2014, Salvi 2008) in which the risk of bias was high for several domains including randomisation.<sup>13-15</sup> No relevant, recent systematic reviews were identified.

Sun and colleagues conducted a RCT in which patients attending ED with syncope were randomised to receive either a syncope protocol in an observation unit (n=62) or usual care (n=62).<sup>13</sup> where the maximum stay in the observation unit could not exceed than 24 hours.

In terms of primary outcomes, patients randomised to the intervention spent less time in hospital at the index visit (29 vs. 47 hours p<0.001) and were less likely to be admitted to hospital (RR 0.16 (95% CI 0.09, 0.29) p<0.001). There were no differences in the secondary outcomes of serious events, quality of life (QoL) or satisfaction with care between groups. A reduction in costs was reported but no formal statistical comparison was performed (index visit US\$1400 vs. 2420, 30 days US\$1800 vs.2520 (2011 data)).

The first of the two nRCT compared usual care with treatment in a 'day hospital' for hyperglycaemic crisis from which the main result was improved readmission rates and associated costs (Benaiges 2014), whilst the second nRCT compared a specialist geriatric ED intervention with a standard ED procedure (Salvi 2008) but without evidence of any differences in outcome and had significant differences in baseline demographic data. <sup>14,15</sup>

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#### **Community hospital (CH) interventions** (Appendix 4)

Two RCTs were identified describing a community hospital (CH) intervention as an alternative to acute hospital (AH) care<sup>16-19</sup> and no relevant, recent systematic reviews.

Both RCTs were at low risk of bias overall. In the RCT by Vicente, participants were randomised following triage at home to either go to a CH (n=410) or to the ED (n=396).<sup>16</sup> The data presented were limited. The authors reported that the nurse attending the patient at home sent 90 intervention participants to the CH (primary outcome) although six of those individuals were subsequently transferred from the CH to the ED (secondary outcome). There were no formal statistical analyses nor were cost data presented.

The Garåsen RCT compared CH care (n=72) to AH care (n=72) and was published over three separate papers. <sup>17-19</sup> There was no distinction between primary and secondary outcomes. At 26 weeks, there were fewer readmissions in the CH group versus the AH group (19% vs. 36%, p=0.02) and more people receiving no care (25% vs. 10%, p=0.01). At 12 months, there were fewer deaths in the CH group (18% vs. 31%, p=0.03) although the observation period was considerably longer in the CH group (335.7 vs. 292.8 days, p=0.01). Total cost of treatment was less in the CH group compared with those receiving AH care NOK 39,650 ((95% CI kr 30 996-48,304) versus NOK 73,417 (95% CI NOK 52 992-93,843)) data collected 2003-2005 (p = 0.002). Average health services costs per patient/day for the entire observation period was NOK 606 (95% CI £ 450- 761) in the CH group compared to NOK 802 (95% CI NOK 641-962) in the AH group (p = 0.026).

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#### Hospital-at-Home (HaH) interventions (Appendix 4)

Eight of the HaH studies were focused on specific conditions: heart failure (n=3), chronic obstructive pulmonary disease (n=1), pulmonary embolism (n=1), pneumonia (n=1), stroke (n=1), and uncomplicated diverticulitis (n=1). <sup>20-28</sup> The remaining three HaH studies recruited older participants with a range of conditions, and two of these recruited from residential homes.<sup>29-33</sup> All the specific condition studies were included in recent (2010-2016) systematic reviews <sup>34-40</sup> but no relevant reviews for the older participants with a range of conditions were identified.

#### Heart failure (HF)

Three RCTs were identified on HaH for HF and their results published in four separate papers.<sup>20-23</sup> These studies were included in two previous reviews of HaH one which focused on HF (Quaddoura 2015).<sup>34,35</sup> This review used the Cochrane risk of bias tool and described the overall quality of the RCTs as modest. The AMSTAR rating of the review highlighted a lack of description of excluded studies and the combination of different QoL measures in meta-analysis.

In the Quaddoura systematic review the patients were randomised to either HaH or AH within the ED and the primary outcomes of the review were hospital readmissions and mortality. HaH increased time to first readmission (mean difference (MD) 14.13 days [95% CI 10.36, 17.91] p=0.015 using data from two RCTs (n=132).<sup>22-23</sup> although there was no strong evidence of an effect on the rate of readmission (RR 0.68 [0.42, 1.09]) using data from two RCTs (n=172).<sup>20,22</sup> This is a sizeable reduction, but consistent with chance in a data set of this size. An improvement was reported in health-related QoL at both 6 and 12 months

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(standardized MD (SMD) -0.31 [-0.45 to -0.18]; SMD -0.17 [-0.31 to -0.02] respectively). HaH was comparable to AH care on all-cause mortality (RR 0.94 (0.67, 1.32)) using data from all three RCTs. These studies also showed a significant reduction in costs for the index treatment period (p<0.001). Two trials<sup>20,23</sup> reported lower costs in the HaH group at 12 months, although the difference was not statistically significant in one of the studies.<sup>20</sup> When the authors of this particular review calculated total costs for these two trials, both indicated a cost reduction for HaH compared to AH care.

#### Chronic obstructive pulmonary disease (COPD)

An RCT by Ricauda was published in 2008 and was also included in two recent systematic reviews - one focusing on COPD and one more generally on HaH.<sup>24,35,36</sup> The high quality COPD review included eight RCTs, one of which described HaH in an early discharge setting, plus the Ricauda trial and six which were published prior to our 2005 inclusion date.

The Ricauda RCT compared HaH (n=52) with AH (n=52) and was conducted with low risk of bias. The primary outcomes were hospital readmission and mortality rates at 6 months. The secondary outcomes included a range of depression, functional, cognitive and nutritional measures as well as costs.

The study showed that there were fewer hospital readmissions for HaH patients compared to AH patients at 6 months (42% vs 87%, p=0.001) although HaH patients had a longer length of stay than those in the AH group (15.5 SD±9.5 vs 11.0 ±SD 7.9 days, p=0.01). Whilst HaH patients experienced improvements in depression and QoL scores during the study, there was no evidence of difference between the two

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groups for these outcomes at 6 months. Cumulative mortality at 6 months was comparable between groups (20.2%).

All patients discharged from HaH completed the care programme at home, whereas 11.5% of AH patients continued their care in a long-term facility after hospital discharge, with an average daily cost of \$174.7 for a mean period of 25  $\pm$ 8.7 days. Overall - on a cost per patient per day basis - HaH care was less expensive than that given to the AH group (\$101.4  $\pm$  61.3 vs \$151.7  $\pm$ 96.4, p=0.002). This RCT reflected the results of the published systematic review.<sup>36</sup>

#### Pulmonary embolism

Our review identified one published nRCT of HaH (Rodriguez-Cerillo 2009) for patients with pulmonary embolism which was also included in a recent systematic review with seven other observational studies (Vinson 2012).<sup>25,37</sup> The high quality review concluded that the overall incidence of mortality at 90 days was very low.

The nRCT compared HaH (n=30) with AH (n=31) and was at high risk of bias overall.<sup>25</sup> No distinctions between primary and secondary outcomes were made. Mean length of stay was not statistically different comparing HaH with the AH group (8.9 days (7–14 days) vs. 10.6 days (6–20 days)). No patients treated at home required unexpected return to hospital during admission. There was no major bleeding, thrombosis or death in either group at 90 days in the nRCT.<sup>25</sup> There were no cost data reported.

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#### Pneumonia

Our review identified one RCT (Carratala 2005) published and included in a recent systematic review (Chalmers 2011) which also described a further five studies comprising a variety of designs).<sup>26,38</sup> The RCT compared HAH (n=110) with AH (n=114) and was at low risk of bias. The primary outcome was the percentage of patients with an 'overall successful outcome' according to seven predefined criteria<sup>26</sup> whilst secondary outcomes were patients' QoL and satisfaction.

An overall successful outcome was achieved in 83.6% of HaH patients and 80.7% of AH patients (absolute difference 2.9% [95% CI, 7.1-12.9]). Subsequent hospital admissions were comparable between groups (6.3 vs. 7.0%). More HaH patients were satisfied with their overall care (91.2 vs. 79.1%; ab 12.1% [CI, 1.8 to 22.5%]). Reported QoL scores were comparable between groups as was the percentage of patients with adverse drug reactions (9.1 vs. 9.6%), medical complications (0.9 vs. 2.6%), and overall mortality (0.9 vs. 0%) for HAH and AH patient groups respectively. There were no cost data presented. This RCT data reflects the result of the systematic review by Chalmers 2011. <sup>38</sup>

#### Stroke

One RCT on HaH for stroke patients (Kalra 2005) was published and also included in two previous systematic reviews.<sup>27,35,39</sup> This RCT was at low risk of bias. The primary outcome measure was death or institutionalisation at one year. This threearm study randomised patients into care on a stroke unit (SU) (n=152), care in a general ward (GW) with stroke expert advice (n=152) and HaH with stroke expert advice (n=153) within 72 hours after recruitment in the ED department. 03.05.17

Mortality and institutionalisation at one year were lower in the SU group compared with either the GW (14 vs. 30%, p < 0.001) or HaH groups (14 vs. 24%, p=0.03). Significantly fewer patients cared for on the SU died compared with those in the GW group (9 vs. 23%, p = 0.001). The SU group showed greater improvement on basic activities of daily living compared with the other two groups (change in Barthel Index 10 vs. 7, p < 0.002). QoL at three months was significantly better in SU and HaH patients. There was greater dissatisfaction with care in the GW group compared with SU or HaH groups. The total costs of stroke care per patient over 12 months (data collected 2005-2008) were £11,450 for the SU group, £9527 for GW group and £6840 for HaH group.

#### Uncomplicated diverticulitis

Our systematic review found one nRCT(Rodriguez-Cerrillo 2013).<sup>28</sup> This study was also included in a recent, moderate quality integrative review on admission-avoidance HaH services.<sup>40</sup> This nRCT compared HaH (n=34) with AH (n=18) for patients with uncomplicated diverticulitis and was, overall, at high risk of bias with no defined primary or secondary outcomes were defined. No statistical detail was provided about any of the data presented. None of the patients treated at home were transferred to the acute hospital. The mean length of stay in the intervention group was 9 days, compared with 10 days in AH. HaH treatment was associated with a cost reduction of €1368 per patient.

#### Older population with acute medical problems

There were three studies identified published over five papers<sup>29-33</sup> and no relevant recent systematic reviews. One nRCT recruited acutely ill older persons and was published across three separate papers (Leff 2005, main publication).<sup>29-31</sup> This nRCT

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compared HaH (n=169) with AH (n=286) with the majority of patients being identified the morning after admission. The study was at high risk of bias.<sup>29</sup> There was no distinction made between primary and secondary outcomes. Patients treated with HaH had a shorter length of stay compared with those given AH care (3.2 vs. 4.9 days, p =0.004). The mean treatment cost was lower for HaH care than for acute hospital care (\$5081 vs. \$7480, p< 0.001). Eight weeks after admission, there were no differences in the use of health services between HaH and AH patients in terms of ED visits, (0.23 (SD 0.66) 0.22 (SD 0.57)) or readmission (0.28 (SD 0.59) 0.27 (SD 0.55)).

The nRCT by Crilly 2010 recruited elderly nursing home patients presenting at ED but who were willing to receive care back in their nursing home (n=62) and compared these with historical control care home patients who had been hospitalised (n=115). The study was at high risk of bias <sup>32</sup> and no primary outcomes were specified. Intervention participants experienced a longer time in ED than those who had been admitted into hospital (9.94 vs. 7.01 hours p=0.005) but required less time being subsequently cared for (2.19 vs. 6.2 days p<0.001). Overall, the length of an episode of care in days (9.56 (1.26) vs. 6.20 (0.59) days, p=0.14) and the number of readmissions within 28 days (11.3 vs. 11.3, p=0.99) were not statistically different between the two groups. There were no mortality or cost data presented.

The nRCT by Lau 2013 assessed residents of a care home presenting at ED who were subsequently treated back in their care home (n=95) and compared data with historical hospital controls i.e. not from care homes (n=167).<sup>33</sup> No primary outcomes were specified and the study was at high risk of bias. Length of stay was significantly shorter for those in the intervention group compared with the controls (2.0 vs. 11.0

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days p<0.001) although mortality (11 (11.6%) vs. 20 (12.0%), p=0.924) and readmission rates (39 (41.1%) vs. 68 (40.7%), p=0.963) at 6 months were comparable between groups. There were no cost data presented.

# Characteristics of those older patients for whom the decision to admit to hospital may be unclear (Appendix 6)

Fifteen of the studies included in our systematic review recruited a population with a mean age of more than 75 years, despite the inclusion criterion specifying those over 65 years. Whilst 9/19 studies specifically stated their recruited population was multi-morbid, it is plausible that all the study populations were and so this is very likely to be a factor which impacts on decision-making in acute medical care. Eight studies specified a particular degree of severity for dementia as an inclusion criterion but, in practice, this is a difficult assessment to make in the acute care context. There were inclusion/exclusion criteria in nine of the studies which specified the importance taking account of an individual's home situation, social support networks and coping abilities as part of the decision-making process.

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#### Discussion

#### Summary of principal findings

The findings of our systematic review show that alternatives to acute hospital care at the point of potential admission for people aged over 65 years can be safe, with comparable mortality and clinical outcomes across a range of acute and chronic conditions. They also have the potential to reduce healthcare spending. The exception to the evidence of benefit of HaH is the treatment of stroke patients, who fare much worse with HaH intervention compared to treatment in a stroke unit. The authors of this study suggest that these differences are due to the overall expertise available in the stroke unit as opposed to care given by generic hospital or homecare staff advised by specialised stroke health professionals. It is recommended therefore that in most cases, in line with current NHS practice for stroke, care should to be provided in specialist units.<sup>41</sup> The key features of older patients for whom the decision to admit may be uncertain are age more than 75 years, co/multi-morbidities, dementia, home situation, social support and individual coping abilities.

#### Comparison with previous literature

As part of our systematic review, any relevant systematic review published in 2010-2016 was included and referred to when discussing the more recent studies. All of these reviews were on the topic of HaH interventions. In addition to being older evidence, some of the previous reviews in contrast to our own included a number of uncontrolled observational studies. Some also included studies in which HaH interventions were applied in the non-emergency or post-discharge settings. By contrast, our systematic review focuses on bringing together controlled studies on

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alternatives to acute hospitalisation at the point of potential admission for the over 65s.

#### Clinical and research implications

For health professionals, making a decision to admit an older patient can prove very difficult. Decision-making for each individual patient draws upon a range of professional experience and expertise, and should also be influenced by broader factors such as living conditions and individual/family/carer coping, in addition to care preferences. If alternatives to acute admission are available, health professionals must be confident about using these alternative pathways for their patients<sup>5</sup> and whilst many of the interventions in this review may provide viable alternatives to acute care, they may not exist in some healthcare communities or geographical regions. Nevertheless, our review suggests that where established alternatives to admission exist, clinicians should offer these with a degree of confidence and not assume that hospital admission is always the best or safest option for their patient. Future research should aim to provide more comprehensive evidence of both the clinical and cost effectiveness of a wider range of hospital alternatives for a greater range of health issues, as well as exploring in more detail the determinants and outcomes of decision-making under conditions of uncertainty. Many of the studies included in this review recruited highly defined populations and it would be helpful to understand whether the findings can be replicated in more general patient groups. There is also much to be done to improve the collection of data on patient-related outcomes, carer and health professional acceptability, and costs.

#### Strengths and limitations of review

Our systematic review was conducted to high methodological standards.<sup>42</sup> The majority of evidence presented is based on HaH services, although this includes

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treatment of a wide range of conditions. Whilst not all the included studies were randomised or considered to be at low risk of bias, these issues are clearly highlighted and the included studies cover a variety of alternative approaches to hospital admission. The majority of the included studies offer little or no cost data which makes it difficult to assess the cost-effectiveness of any these alternatives to acute hospital care. Whilst writing our protocol we planned to carry out a meta-analysis on suitable data. However, the data we identified were insufficient, in terms of quantity (i.e. often drawn from a single study), quality (i.e. from nRCT) or homogeneity. Where sufficient data were identified - on HaH for heart failure – an analysis had already been conducted within a previous review.<sup>34</sup>

In conclusion, this systematic review describes and assesses evidence on alternatives to acute care for older patients and shows that many of the options available are safe and appear to reduce resource use.

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#### **Competing interests**

None of the authors have any competing interests to declare

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#### Authors' contribution

**ALH** Research Fellow and lead systematic reviewer conducting all stages of the review and responsible for the initial draft of paper.

**MC** Research Fellow with specific expertise in Patient and Public Involvement (PPI) as well as older age community care. Contributing to discussion as the review progressed. Commenting and editing on the drafts of the paper.

**AH** Senior Research Fellow with specific expertise in patient-related outcomes. Contributing to discussion as the review progressed. Commenting and editing on the drafts of the paper.

**WH** Professor with specific expertise in health economics. Contributing to discussion as the review progressed. Commenting and editing on the drafts of the paper.

**CM** Reader with specific expertise in trial design and statistical analysis. Contributing to discussion as the review progressed. Commenting and editing on the drafts of the paper.

**JB** Professor with specific expertise in emergency care. Contributing to discussion as the review progressed. Commenting and editing on the drafts of the paper.

SP Principal Investigator and Professor with specific expertise in primary health care.

Third reviewer of data. Commenting and editing on the drafts of the paper.

#### Data sharing statement

This is a systematic review and all the data we have collected is either in the main text and summary table or in the on-line appendices.

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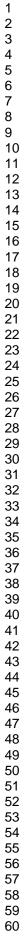
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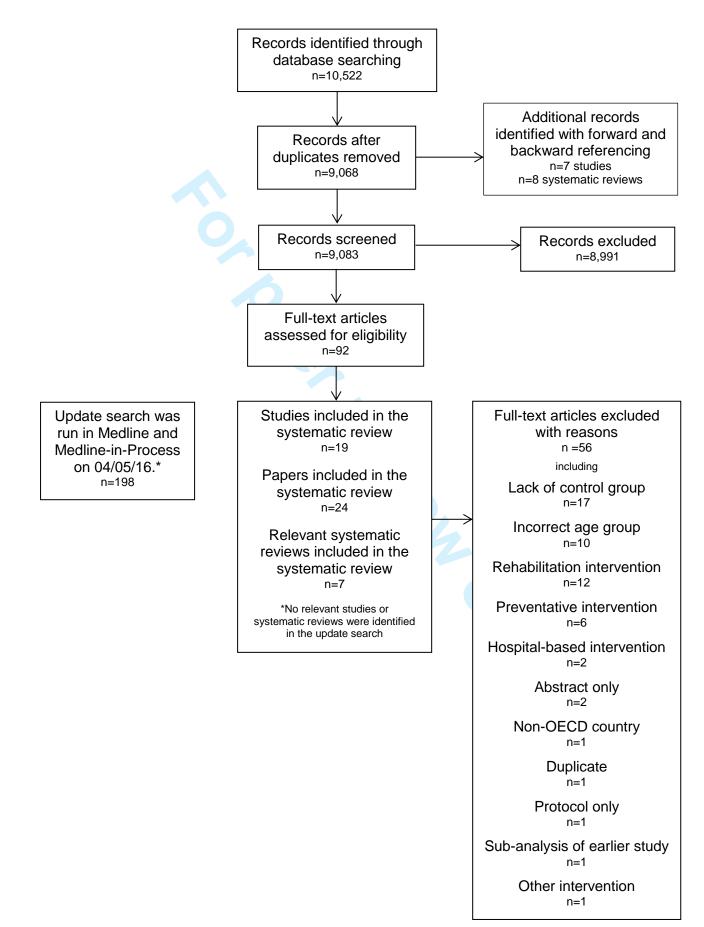
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#### **PRISMA** flow diagram





### Appendix 1: Parent search strategy run in Medline

Database: Medline In-process - current week, Medline 1950 to present

Search Strategy: Run April 24th 2015

- 1 intervention?ti. or (intervention? adj6 (clinician? or collaborat\$ or community or complex or DESIGN\$ or doctor? or educational or family doctor? or family physician? or family practitioner? or financial or GP or general practice? or hospital? or impact? or improv\$ or individuali?e? or individuali?ing or interdisciplin\$ or multicomponent or multi-component or multidisciplin\$ or multi-disciplin\$ or multifacet\$ or multi-facet\$ or multimodal\$ or multi-modal\$ or personali?e? or personali?ing or pharmacies or pharmacist? or pharmacy or physician? or provider? or regulatory or regulatory or tailor\$ or target\$ or team\$ or usual care)).ab. (178760)
- 2 (pre-intervention? or preintervention? or "pre intervention?" or post-intervention? or post-intervention?").ti,ab. (11719)
- 3 (hospital\$ or patient?).hw. and (study or studies or care or health\$ or practitioner? or provider? or physician? or nurse? or nursing or doctor?).ti,hw. (747131)
- 4 demonstration project?.ti,ab. (2027)
- 5 (pre-post or "pre test\$" or pretest\$ or posttest\$ or "post test\$" or (pre adj5 post)).ti,ab. (72037)
- 6 (pre-workshop or post-workshop or (before adj3 workshop) or (after adj3 workshop)).ti,ab. (653)
- 7 trial.ti. or ((study adj3 aim?) or "our study").ab. (697929)
- 8 (before adj10 (after or during)).ti,ab. (375455)
- 9 ("quasi-experiment\$" or quasiexperiment\$ or "quasi random\$" or quasirandom\$ or "quasi control\$" or quasicontrol\$ or ((quasi\$ or experimental) adj3 (method\$ or study or trial or design\$))).ti,ab,hw. (107858)
- 10 ("time series" adj2 interrupt\$).ti,ab,hw. (1212)
- 11 (time points adj3 (over or multiple or three or four or five or six or seven or eight or nine or ten or eleven or twelve or month\$ or hour? or day? or "more than")).ab. (10245)
- 12 pilot.ti. (43282)
- 13 Pilot projects/ (86631)
- 14 (clinical trial or controlled clinical trial or multicenter study).pt. (644558)
- 15 (multicentre or multicenter or multi-centre or multi-center).ti. (31588)

- random\$.ti,ab. or controlled.ti. (809402)
- (control adj3 (area or cohort? or compare? or condition or design or group? or intervention? or participant? or study)).ab. not (controlled clinical trial or randomized controlled trial).pt. (440969)
- Aged/ (2394306)
- "Aged, 80 and over"/ (647729)
- older adults.mp. (38411)
- elderly adults.mp. (2417)
- over 65 years.mp. (3421)
- virtual ward.mp. (12)
- intermediate care.mp. (1478)
- Crisis response.mp. (103)
- Crisis resolution.mp. (99)
- reablement.mp. (12)
- re-ablement.mp. (11)
- hospital care at home.mp. (14)
- hospital-at-home.mp. (289)
- home hospital.mp. (150)
- medical day hospital care.mp. (2)
- day hospital.mp. (2435)
- out-patient facility.mp. (13)
- Domiciliary care.mp. (247)
- intermediate services.mp. (7)
- Intermediate Care Facilities/ (639)
- Home Care Services, Hospital-Based/ (1662)
- Home Health Nursing/ (58)
- Home Nursing/ (8049)
- admission avoidance.mp. (56)
- outreach program.mp. (677)
- hospital outreach.mp. (27)
- nursing-led units.mp. (3)
- hospital in home.mp. (8)
- hospital in the home.mp. (123)
- medical home care.mp. (39)

#### **BMJ Open**

3	48	Crisis intervention service.mp. (31)
4 5	49	Geriatric emergency management practice model.mp. (1)
6 7		day unit.mp. (169)
8	50 51	Day Care/ (4670)
9 10		
11 12	52	day centre.mp. (170)
13	53	comprehensive elderly care.mp. (2)
14 15	54	Substitutive care.mp. (1)
16 17	55	shared care.mp. (916)
18	56	guided care.mp. (69)
19 20	57	home-based versus hospital-based.mp. (11)
21 22	58	home hospitalisation.mp. (28)
23 24	59	rapid response team.mp. (515)
25	60	rapid response nurse.mp. (2)
26 27	61	Hospitals, Community/ (10479)
28 29	62	*Ambulatory Care/ (15963)
30	63	*Health Services for the Aged/ (12112)
31 32	64	or/1-17 (3278427)
33 34	65	or/23-63 (57831)
35 36	66	or/18-22 (2428347)
37	67	64 and 65 and 66 (11288)
38 39	68	67 not (child/ or infant/ or adolescent/ or maternal health services/) (9807)
40 41 42 43 44 45	69	68 not (case report/ or case study/ or letter/ or editorial/ or expert opinion.mp.) [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier] (9192)
46 47 48 49 50 51 52 53 54 55 56 57 58 59 60	70	69 not (Algeria\$ or Egypt\$ or Liby\$ or Morocc\$ or Tunisia\$ or Western Sahara\$ or Angola\$ or Benin or Botswana\$ or Burkina Faso or Burundi or Cameroon or Cape Verde or Central African Republic or Chad or Comoros or Congo or Djibouti or Eritrea or Ethiopia\$ or Gabon or Gambia\$ or Ghana or Guinea or Keny\$ or Lesotho or Liberia or Madagasca\$ or Malawi or Mali or Mauritania or Mauritius or Mayotte or Mozambiq\$ or Namibia\$ or Niger or Nigeria\$ or Reunion or Rwand\$ or Saint Helena or Senegal or Seychelles or Sierra Leone or Somalia or South Africa\$ or Sudan or Swaziland or Tanzania or Togo or Ugand\$ or Zambia\$ or Zimbabw\$ or China or Chinese or Hong Kong or Macao or Mongolia\$ or Taiwan\$ or Belarus or Moldov\$ or Russia\$ or Ukraine or Afghanistan or Armenia\$ or Azerbaijan or Bahrain or Cyprus or Cypriot or Georgia\$ or Iran\$ or Iraq\$ or Israel\$ or Jordan\$ or Kazakhstan or Kuwait or Kyrgyzstan or Leban\$ or Oman or Pakistan\$ or Palestin\$ or Qatar or Saudi Arabia or Syria\$ or Tajikistan or Turkmenistan or United Arab Emirates

or Uzbekistan or Yemen or Bangladesh\$ or Bhutan or British Indian Ocean Territory or Brunei Darussalam or Cambodia\$ or India\$ or Indonesia\$ or Lao or People's Democratic Republic or Malaysia\$ or Maldives or Myanmar or Nepal or Philippin\$ or Singapore or Sri Lanka or Thai\$ or Timor Leste or Vietnam or Albania\$ or Andorra or Bosnia\$ or Herzegovina\$ or Bulgaria\$ or Croatia\$ or Estonia or Faroe Islands or Greenland or Liechtenstein or Lithuani\$ or Macedonia or Malta or maltese or Romania or Serbia\$ or Montenegro or Slovenia or Svalbard or Argentina\$ or Belize or Bolivia\$ or Brazil\$ or chile or Chilean or Colombia\$ or Costa Rica\$ or Cuba or Ecuador or El Salvador or French Guiana or Guatemala\$ or Guyana or Haiti or Honduras or Jamaica\$ or Nicaragua\$ or Panama or Paraguay or Peru or Puerto Rico or Suriname or Uruguay or Venezuela or developing countr\$ or south America\$).ti,sh. (8719)

- 71 admission\*.ab. (140603)
- 72 hospital\*.ab. (747796)
- 73 71 or 72 (804011)

- 74 70 and 73 (3851)
- 75 limit 74 to yr="2005 -Current" (1880)
- 76 remove duplicates from 75 (1829)

#### Appendix 2: EPOC Risk of bias

#### Paramedic (PP) / emergency care practitioner (ECP) interventions

#### Study: Mason 2007 RCT - older population with mixed conditions

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	Low risk	'We used cluster randomisation to reduce the risk of contamination (practice in the control group being influenced by the presence of the paramedic practitioner in the community) and to allow service level, rather than individual patient level, evaluation of the intervention. Weeks were randomised before the start of the study (to allow for rostering of the paramedic practitioners) to the paramedic practitioner service being active (intervention) or inactive (control), when the standard 999 service was available'
Was allocation adequately concealed?	Low risk	'Episode of care with some form of centralised randomisation scheme'
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. ED attendance
Were baseline characteristics similar?	Low risk	Baseline characteristics of intervention and control groups were reported and similar
Were incomplete outcome data adequately addressed?	Low risk	Flow of patients through trial was presented and intention-to-treat analysis used
Was knowledge of allocated interventions adequately prevented during study?	Low risk	Majority of outcomes were objective but there was one about satisfaction with service i.e. subjective
Was study adequately protected against contamination?	Low risk	'We used cluster randomisation to reduce the risk of contamination (practice in the control group being influenced by the presence of the paramedic practitioner in the community) and to allow service level, rather than individual patient level, evaluation of the intervention'.
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Nothing obvious

#### Study: Gray 2008 historical controls - older people with falls

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	High risk	'From January to April 2006 inclusive, all the patients seen by the ECP service who had rung 999 with a diagnosis of either breathing difficulties or an elderly patient (.65 years of age) with a fall were reviewed.' 'Comparison data were taken from January to April 2005 inclusive for attendances to the same ED for patients with the same criteria as above seen by non- ECP ambulance service personnel'
Was allocation adequately concealed?	High risk	As above
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. ED attendance
Were baseline characteristics similar?	Unclear risk	No details given other than 'elderly patients >65yrs with a fall'
Were incomplete outcome data adequately addressed?	Unclear risk	No reference to missing data or how it might be handled
Was knowledge of allocated interventions adequately prevented during study?	Low risk	Outcome measures were all objective
Was study adequately protected against contamination?	Low risk	Different data collection time-periods were reported for each group
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Only used half of the study population

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	High risk	'Potential 'intervention' trust sites were selected on the basis of their heterogeneity of service delivery of ECP care. 'Contro trust sites that did not employ ECPs, but were in close geographical proximity (i.e. within the same or in a neighbouring county) and which offered the same service configurations as the intervention trusts, were then selected'
Was allocation adequately concealed?	High risk	As above
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. ED attendance
Were baseline characteristics similar?	High risk	For the care home subgroup, figures were given on selected baseline characteristics but no formal comparison appeared t be made. On face value, clinical characteristics were not balanced e.g. adult medical 30 vs.41%, adult trauma 46 vs.13%
Were incomplete outcome data adequately addressed?	Unclear risk	No reference to missing data or how it might be handled
Was knowledge of allocated interventions adequately prevented during study?	Low risk	Outcome measures were all objective
Was study adequately protected against contamination?	Low risk	Intervention and control were delivered in different locations
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Nothing obvious

#### **Emergency Department (ED) interventions**

#### Study: Sun 2014 RCT - syncope

Bias	Authors' judgement	Support for judgement		
Was allocation sequence adequately generated?	Low risk	'Patients were block randomized (n=4) by site in a 1:1 ratio to either the observation protocol or routine inpatient admission'		
Was allocation adequately concealed?	Low risk	'A computer generated the study arm assignment at randomization, and no research personnel had advance knowledge of study arm assignment. We could not blind this health service intervention to patients, providers, or research personnel.'		
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. inpatient admission rates		
Were baseline characteristics similar?	Low risk	Baseline characteristics of intervention and control groups were reported and similar		
Were incomplete outcome data adequately addressed?	Low risk	Flow chart of participants provided and intention-to-treat analysis performed		
Was knowledge of allocated interventions adequately prevented during study?	Low risk	Outcome measures were objective but one secondary outcome - participant satisfaction – was subjective		
Was study adequately protected against contamination?	Unclear risk	Treatment and control were allocated and delivered in same location so possible for participants to swap allocation		
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section		
Was study free from other risks of bias?	Low risk	Nothing obvious		

#### Study: Salvi 2008 CT - older population with mixed conditions

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	High risk	Trained research assistant (VM) screened patients presenting to the ED for Monday to Friday from 9:00 a.m to 6:00 p.m
	, i i i i i i i i i i i i i i i i i i i	using a standard information sheet explaining the study protocol to patients and proxies'
Was allocation adequately concealed?	High risk	As above
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. number of initial admissions
Were baseline characteristics similar?	High risk	Intervention and control groups were unbalanced - age, 78.1(7) vs.82.5(7.2) p<0.001, female 47 vs. 68% p=0.004, married
		70 vs. 40% p<0.001, SPMSQ 2.5(3.3) vs. 5.2(4.2) p<0.001, ADL4.3(2) vs. 3.2(2.5) p=0.001
Were incomplete outcome data adequately addressed?	Unclear risk	No reference to missing data or how it might be handled
Was knowledge of allocated interventions adequately prevented during study?	Low risk	All outcome measures were objective
Was study adequately protected against contamination?	Unclear risk	Treatment and control were delivered in different locations
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Nothing obvious
	•	
Study: Benaiges 2014 CT - hyperglycaemia		

#### Study: Benaiges 2014 CT - hyperglycaemia

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	High risk	'Patients were assigned to the DH group if they were admitted to hospital within DH opening hours (weekdays from 8:00 a.m to 4:00 p.m); otherwise they were treated in the emergency department and subsequently hospitalized'
Was allocation adequately concealed?	High risk	As above
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. number of ER visits
Were baseline characteristics similar?	Low risk	Baseline characteristics of treatment and control groups were reported and similar
Were incomplete outcome data adequately addressed?	Unclear risk	No reference to missing data or how it might be handled
Was knowledge of allocated interventions adequately prevented during study?	Low risk	All outcome measures were objective
Was study adequately protected against contamination?	Low risk	'Patients were treated with same protocol for both DH and CH' so contamination was possible
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Nothing obvious

#### **BMJ Open**

#### Community hospital interventions

#### Study: Vicente 2014 RCT

Bias	Authors' judgement	Support for judgement		
Was allocation sequence adequately generated?	Low risk	'The dispatchers at the EMCC randomized older adults into the study. A sealed envelope randomization procedure was initiated when the dispatcher received the incoming call and identified the participant as an individual aged 65 who res in the specified geographical area and was assigned a priority level 2 or 3, and the call occurred between 8:00 a.m. ar 10:00 p.m'		
Was allocation adequately concealed?	Low risk	'The envelope contained the name of the EMS Company 1 or the name of the EMS Company 2. There was an equal chance (1:1) of being assigned to either of the ambulance companies'		
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. number of individuals sent direct to community hospital		
Were baseline characteristics similar?	High risk	There was a difference in the priority level when ambulance sent out (% individuals) – Level 1) 1.6 vs. 0%, Level 2) 59 vs. 47%, Level 3) 39 vs.53%, p=0.001		
Were incomplete outcome data adequately addressed?	Unclear risk	No reference to missing data or how it might be handled		
Was knowledge of allocated interventions adequately prevented during study?	Low risk	All outcome measures were objective		
Was study adequately protected against contamination?	Low risk	Separate sealed envelope opened for each individual case		
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section		
Was study free from other risks of bias?	Low risk	Nothing obvious		

#### Study: Garasen 2007/8 ab RCT - older population with mixed conditions

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	Low risk	'When an eligible patient was identified and accepted for inclusion, a blinded randomisation was performed by the Clinical Research Department using random number tables in blocks to ensure balanced groups'
Was allocation adequately concealed?	Low risk	As above
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. number of readmissions for index disease
Were baseline characteristics similar?	Unclear risk	Baseline characteristics of intervention and control groups were described but no formal comparison reported
Were incomplete outcome data adequately addressed?	Unclear	No reference to missing data or how it might be handled
Was knowledge of allocated interventions adequately prevented during study?	Low risk	All outcome measures were objective
Was study adequately protected against contamination?	Low risk	Participants were allocated using a clear process but 8 individuals originally assigned to CH were later assigned to GH
Was study free from selective outcome reporting?	Low risk	All outcomes described in methods section were reported in results section plus 12-month data was used in Garasen 2008
Was study free from other risks of bias?	Low risk	Nothing obvious

#### Hospital-at-Home (HAH) interventions: heart failure

#### Study: Patel 2008 pilot RCT - heart failure

Was study free from selective outcome reporting?	Low risk	All outcomes described in methods section were reported in results section plus 12-month data was used in Garasen 2008
Was study free from other risks of bias?	Low risk	Nothing obvious
Hospital-at-Home (HAH) interventions: heart	failure	
Study: Patel 2008 pilot RCT - heart failure		
Bias	Authors' judgement	Support for judgement
	Authors' judgement	Support for judgement
Bias Was allocation sequence adequately generated? Was allocation adequately concealed?	Low risk	Open pilot RCT
Was allocation sequence adequately generated? Was allocation adequately concealed? Were baseline outcome measurements similar?	Low risk Unclear risk	Open pilot RCT Used 'random number generator under direction of specialist nurse or hospital admission staff' but no further detail provided
Was allocation sequence adequately generated? Was allocation adequately concealed? Were baseline outcome measurements similar? Were baseline characteristics similar?	Low risk Unclear risk Low risk	Open pilot RCT Used 'random number generator under direction of specialist nurse or hospital admission staff' but no further detail provided Mostly not relevant since majority of outcomes were related to process Baseline characteristics of intervention and control groups were reported and small differences seen in gender, education
Was allocation sequence adequately generated? Was allocation adequately concealed? Were baseline outcome measurements similar? Were baseline characteristics similar? Were incomplete outcome data adequately addressed?	Low risk Unclear risk Low risk Low risk	Open pilot RCT Used 'random number generator under direction of specialist nurse or hospital admission staff' but no further detail provided Mostly not relevant since majority of outcomes were related to process Baseline characteristics of intervention and control groups were reported and small differences seen in gender, education and two particular co-morbidities
Was allocation sequence adequately generated? Was allocation adequately concealed? Were baseline outcome measurements similar? Were baseline characteristics similar? Were incomplete outcome data adequately addressed? Was knowledge of allocated interventions adequately prevented during study?	Low risk Unclear risk Low risk Low risk High risk	Open pilot RCT Used 'random number generator under direction of specialist nurse or hospital admission staff' but no further detail provided Mostly not relevant since majority of outcomes were related to process Baseline characteristics of intervention and control groups were reported and small differences seen in gender, education and two particular co-morbidities Flow of patients was described although description of analysis was lacking
Was allocation sequence adequately generated? Was allocation adequately concealed?	Low risk Unclear risk Low risk Low risk High risk Unclear risk	Open pilot RCT Used 'random number generator under direction of specialist nurse or hospital admission staff' but no further detail provided Mostly not relevant since majority of outcomes were related to process Baseline characteristics of intervention and control groups were reported and small differences seen in gender, education and two particular co-morbidities Flow of patients was described although description of analysis was lacking No detail provided

#### Study: Mendoza 2009/Garcia-Soleto 2013 RCT - heart failure

Bias	Authors' judgement	Support for judgement	
Was allocation sequence adequately generated?	Low risk	'Randomly assigned (1:1) to one of the intervention groups according to an externally generated sequence, which was	
		hidden from the clinicians until the patient had given consent to participate'	
Was allocation adequately concealed?	Low risk	As above	
Were baseline outcome measurements similar?	Low risk	Mostly not relevant since outcomes were related to process but functional status and health-related QoL were similar	
Were baseline characteristics similar?	Low risk	Baseline characteristics of intervention and control groups were reported and similar	
Were incomplete outcome data adequately addressed?	Low risk	Patient flow through trial was described and 'per protocol' analysis performed	
Was knowledge of allocated interventions adequately prevented during study?	Unclear risk	No detail provided	
Was study adequately protected against contamination?	Low risk	Treatment and control were delivered in different locations	
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section	
Was study free from other risks of bias?	Low risk	Nothing obvious	

## Study: Tibaldi 2009 RCT - heart failure

Authors' judgement	Support for judgement
Low risk	'By the use of a set of computer-generated random numbers in a 1:1 ratio. The allocation sequence was unknown to any of
	the investigators and was contained in a set of sealed envelopes, each bearing on the outside only the name of the hospital
	and a number, which was opened after the acceptance of the patient'
Low risk	Participants were enrolled within 12-24 hours of ED admission by research assistants, masked to both allocation and
	hypotheses being tested
Low risk	Mostly not relevant since outcomes were related to process but depression, function and nutrition measures were similar
Unclear risk	Baseline characteristics of intervention and control groups were reported and heart rate was significantly different p=0.006
Low risk	Patient flow through trial described and intention-to-treat analysis performed
Unclear risk 🤍	No detail available
Low risk	Treatment and control were delivered in different locations
Low risk	All outcome measures described in methods section were reported in results section
Low risk	Nothing obvious
	Low risk Low risk Unclear risk Low risk Unclear risk Low risk Low risk Low risk Low risk

#### Hospital-at-Home (HAH): COPD

#### Study: Ricauda 2008 RCT - COPD

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	Low risk	Patients were randomised using a set of computer-generated random numbers in a 1:1 ratio.
Was allocation adequately concealed?	Low risk	Allocation sequence was unknown to any of the investigators and kept in a set of sealed envelopes, each bearing on the outside only the name of the hospital and a number. After acceptance of a patient, the ED nurse coordinator, who was not involved in the study, opened the appropriately numbered envelope
Were baseline outcome measurements similar?	Low risk	Mostly not relevant since outcomes were related to process but clinical outcomes e.g. depression were similar
Were baseline characteristics similar?	Low risk	Recorded in DE table
Were incomplete outcome data adequately addressed?	Low risk	Drop outs/loss-to-follow-up were recorded and intention-to-treat analysis performed
Was knowledge of allocated interventions adequately prevented during study?	Unclear risk	Single-blind study since patients were aware of the treatment assignment although physicians and nurses evaluating patients were blinded to the patient's allocation
Was study adequately protected against contamination?	Low risk	Treatment and control were delivered in different locations
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Nothing obvious

### Hospital-at-Home (HAH): Pulmonary embolism

#### Study: Rodriguez-Cerillo 2009 nRCT - non-massive pulmonary embolism

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	High risk	nRCT
Was allocation adequately concealed?	High risk	nRCT
Were baseline outcome measurements similar?	Low risk	Mostly not relevant since outcomes were related to process
Were baseline characteristics similar?	Low risk	Baseline characteristics of treatment and control groups were reported and only difference was prior thromboembolic disease, with these cases all being allocated to hospital
Were incomplete outcome data adequately addressed?	High risk	No patient flow or analysis was described
Was knowledge of allocated interventions adequately prevented during study?	High risk	nRCT
Was study adequately protected against contamination?	Low risk	Clinical decision-making at study entry and any subsequent changes were recorded - although none made in practice
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	High risk	Reported some 'external' decision-making
Hospital-at-Home (HAH): Pneumonia		
Study: Carratala 2005 open RCT - pneumonia		
Bias	Authors' judgement	Support for judgement

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	Low risk	Randomisation was performed by using a computer-generated random code with a block size of 10
Was allocation adequately concealed?	Low risk	Randomisation was stratified by hospital site, and the random code was held centrally, in a sealed envelope, by the clinical epidemiologist. In the emergency department, the infectious disease consultant (in most cases not a study investigator) opened sealed, sequentially numbered opaque envelopes to randomly assign patients who had provided written informed consent and met the study criteria
Were baseline outcome measurements similar?	Low risk	Mostly not relevant since outcomes were related to process
Were baseline characteristics similar?	Low risk	Detailed in DE table
Were incomplete outcome data adequately addressed?	Low risk	Patient flow through trial was reported and intention-to-treat analysis performed
Was knowledge of allocated interventions adequately prevented during study?	Unclear risk	Trial was described as 'unblinded '
Was study adequately protected against contamination?	Low risk	Treatment and control were delivered in different locations
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Unclear risk	Lack of blinding in terms of assessment could be problematic
Hospital-at-Home (HAH): Stroke Study: Kalra 2005 RCT - stroke		0
Bias	Authors' judgement	Support for judgement

#### Hospital-at-Home (HAH): Stroke

#### Study: Kalra 2005 RCT - stroke

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	Low risk	Randomisation was not stratified and was undertaken using the block randomisation technique. This ensured that the number of patients allocated to the stroke unit or to domiciliary services at any one time did not exceed their capacity
Was allocation adequately concealed?	Unclear risk	Randomisation was conducted in blocks of 30 in an office remote from patient treatment areas, so that it would not be possible for those enrolling patients to guess allocation for the vast majority of subjects
Were baseline outcome measurements similar?	Low risk	Mostly not relevant since outcomes were related to process
Were baseline characteristics similar?	Low risk	Baseline characteristics with regard to stroke type, severity, level of impairment and initial disability were well-matched across the three groups
Were incomplete outcome data adequately addressed?	Low risk	Patient flow through trial was reported and intention-to-treat analysis performed
Was knowledge of allocated interventions adequately prevented during study?	Unclear risk	No detail provided
Was study adequately protected against contamination?	Unclear risk	Patients were brought to hospital from domiciliary care if that was considered to be clinically appropriate
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	High risk	In order to ensure that participants were treated in the most appropriate setting, swapping of groups was possible

### Hospital-at-Home (HAH): Uncomplicated diverticulitis

#### Study: Rodriguez-Cerrillo 2013 nRCT - uncomplicated diverticulitis

Bias	Authors' judgement	Support for judgement		
Was allocation sequence adequately generated?	High risk	nRCT		
Was allocation adequately concealed?	High risk	As above		
Were baseline outcome measurements similar?	Low risk	Mostly not relevant since outcomes were related to process		
Were baseline characteristics similar?	Low risk	Very limited details provided about age, gender and presenting complaint		
Were incomplete outcome data adequately addressed?	High risk	No flow of patients was given and only basic analysis reported		
Was knowledge of allocated interventions adequately prevented during study?	High risk	No detail provided		
Was study adequately protected against contamination?	Low risk	Treatment and control were delivered in different locations		
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section		
Was study free from other risks of bias?	Unclear risk	Both analysis and reporting of results were limited		

### Hospital-at-Home (HAH): Mixed population

#### Study: Leff 2005/2009 'quasi experimental' - older population with mixed conditions

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	High risk	<sup>1</sup> During the acute care hospital observation phase (1 November 1990 to 30 September 2001), eligible patients were identified and followed through usual hospital care. <sup>1</sup> During the intervention phase (1 November 2001 to 30 September 2002), eligible patients were identified at the time of admission and were offered the option of receiving their care in hospital-at-home rather than in the acute care hospital'
Was allocation adequately concealed?	High risk	As above
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. time before evaluation
Were baseline characteristics similar?	High risk	Populations differed in measures of poverty, living alone and medication. This was acknowledged but not adjusted for.
Were incomplete outcome data adequately addressed?	Low risk	Intention-to-treat analysis was conducted although there were substantial missing data e.g. in relation to functional status
Was knowledge of allocated interventions adequately prevented during study?	Low risk	All outcomes were objective in Leff 2005 (main publication) but Leff 2009 used self-reported i.e. subjective daily activity of living as an outcome
Was study adequately protected against contamination?	Low risk	Unlikely that control group received intervention and vice versa. Rather, patients were allocated HaH or admitted and, if HaH was unacceptable they were admitted
Was study free from selective outcome reporting?	Low risk	All outcomes described in methods section were reported in results section. Whilst there is no mention of activities of daily living in Leff 2005, this outcome was reported in Leff 2009
Was study free from other risks of bias?	Unclear risk	Possible selection bias related to differences in baseline characteristics e.g. functional status

#### Study: Lau 2003 historical controls

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	High risk	Control trial with historical control group
Was allocation adequately concealed?	High risk	As above
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. palliative care received
Were baseline characteristics similar?	High risk?	There was an imbalance in patient characteristics which may have been due to recruitment bias since the provider was responsible for recruiting patients into the trial. There were more dementia patients treated outside of hospital – although presumably their symptoms were 'fairly mild' since more pronounced behavioural problems were excluded from HaH grou
Were incomplete outcome data adequately addressed?	Unclear risk	No reference to missing data or how it might be handled
Was knowledge of allocated interventions adequately prevented during study?	Low risk	All outcomes were objective
Was study adequately protected against contamination?	Low risk	Unlikely that control group received intervention and vice versa. Rather, patients were allocated HaH or admitted and, if HaH was unacceptable they were admitted
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Nothing obvious

#### Study name: Crilly 2010 'quasi experimental' - older population with mixed conditions

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	High risk	Intervention group included 62 Aged Care Facility (ACF) residents who were enrolled in the Hospital in Nursing home programme during the first 12 months that the programme was operational, from 1 July 2003–30 June 2004. All sample
		members were ACF residents who presented to the ED and were subsequently admitted to hospital
Was allocation adequately concealed?	High risk	As above
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. palliative care received
Were baseline characteristics similar?	Low risk	Baseline characteristics of the study and control are reported and similar
Were incomplete outcome data adequately addressed?	Unclear	No reference to missing data or how it might be handled
Was knowledge of allocated interventions adequately prevented during study?	Low risk	All outcomes were objective
Was study adequately protected against contamination?	Low risk	Unlikely that control group received intervention and vice versa. Rather, patients were allocated HaH or admitted and, if HaH was unacceptable they were admitted
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Nothing obvious
		Nothing obvious

### Appendix 3: AMSTAR ratings of systematic reviews

Study	Was an 'a priori' design provided?	Was there duplicate study selection and data extraction?	Was a comprehensive literature search performed?	Was the status of publication (i.e. grey literature) used as an inclusion criterion?	Was a list of studies (included and excluded) provided?	Were the characteristics of the included studies provided?	Was the scientific quality of the included studies assessed and documented?	Was the scientific quality of the included studies used appropriately in formulating conclusions?	Were the methods used to combine the findings of studies appropriate?	Was the likelihood of publication bias assessed?	Was the conflict of interest included?
Caplan 2012	YES	YES	YES	YES	NO excluded studies not listed	NO studies were grouped by medical, surgical, rehabilitation and psychiatric	YES	YES	YES	YES	YES
Chalmers 2011	YES	YES	YES	NO	NO excluded studies not listed	YES but no ages and no direct reporting of participants in either group	YES but not detailed and whilst Cochrane was cited only one RCT involved	YES	UNCLEAR difficult to judge whether combination of study types is commonly accepted	No	YES
Jeppensen 2012 (Cochrane)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Qaddoura 2015	YES	YES	YES	YES	NO excluded studies not listed	YES	YES	NO relatively high risk of bias but all available data used	NO meta-analysis of two RCTs plus combination of different QoL measures from same study in meta-analysis	NO	YES
Shepperd 2016 (Cochrane)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Varney 2014	YES	NO used single reviewer	YES	YES	NO	YES	YES	NO	N/A no data were combined	NO	YES
Vinson 2012	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	NO

### Appendix 4: description of interventions included in systematic review

Intervention	Description
Paramedic practitioner (PP) /	PPs/ECPs can be trained to 'assess and
emergency care practitioner (ECP)	treat' or to refer patients with a range of
interventions	conditions, as part of pre-hospital care.
	These roles were created in order to
	provide a more appropriate response to
	patients needs in emergency and urgent
	care settings. Their main purpose is to
	improve the pathway of care and patient
	experience, particularly by discharging
	patients at the scene or by referring on to
	the most appropriate care practitioner,
	reducing unnecessary emergency
	department (ED) attendance and avoidable admissions.
Community hospital (CH) interventions	The role of CHs varies between country
	and health systems but, essentially, their
	main role is to provide non-urgent i.e.
	routine or rehabilitative care. However,
	their role can be extended to provide an
	alternative to acute hospital (AH)
	admission for appropriate cases.
Emergency department (ED)	These involve initial assessment in the
interventions	ED, followed by an extended stay for test
	and observation. This extended stay is in
	a bed closely associated with the ED, if
	not part of it.
Hospital-at-home (HaH) interventions	HaH services provide acute or sub-acute
· · · · · ·	treatment in a patient's residence for a
	condition that would normally require
	admission to hospital. It is also known as
	'hospital in the home' and 'home
	hospitalisation'.
Hospital in nursing/care home (HNCH)	HNCH is as a model of admission
interventions	avoidance to treat patients living in
	nursing and residential care homes,
	working on the same principles as HaH for
	community-dwelling residents.

### Appendix 5: Detail of included studies

Author	Study	Participants	Intervention	Control	Outcomes assessed	Results
Year						
Country	Cluster RCT by service	Inclusion criteria:	A paramedic practitioner	A paramedic	Relevant measures &	Intervention vs. control
Mason	Cluster RCT by service	Patients aged ≥60yrs recruited	based in the ambulance	practitioner based in	outcomes	Intervention vs. control
2007	56 clusters	from 1 Sep 2003- 26 Sep 2004.	control room identified	the ambulance control	butcomes	Primary outcomes
2007	50 clusters	Call originated from a Sheffield	eligible calls by the	room identified eligible	Primary outcomes	ED attendance (28 days)
UK	Intervention:	postcode between 8am-8pm, with	presenting complaint and	calls by the presenting	Thinking outcomes	970 (62.6%) vs. 1286 (87.5%)
•	paramedic practitioner	a presenting complaint that fell	notified a paramedic	complaint and notified	ED attendance	p<0.001
	service	within the scope of practice of the	practitioner. All identified	a paramedic	Hospital admissions within	F
	n=1469	paramedic practitioners.	patients were approached	practitioner	28 days	Hospital admissions (28 days)
			face to face either in the	in the ED	Time of call to time of	626 (40.4%) vs. 683 (46.5%)
	Control:	Exclusion criteria:	community or in ED for		discharge	p<0.001
	Inactive paramedic	None given	written consent to follow-	Procedure continued	Patient satisfaction survey	
	practitioner service		up. Patients who had more	as for intervention	including the EQ-5D	Mean Time of call (SD) to time
	n=1549	'If patients were unable to	than one eligible episode			of discharge in mins
		complete questionnaires e.g.	were recruited only once.		Secondary outcomes	235.1(183.3) vs. 277.8(182.6)
		because of cognitive impairment	The research team			p<0.001
		or who were unable to read	independently checked the			
		English—we obtained consent for	ambulance service call		Subsequent unplanned	Patient satisfaction survey
		follow-up by review of clinical	database at the end of each		contact with secondary	including the EQ-5D
		records only.	month for any additional		care at 28 days	Very satisfied with care 656
		Baseline characteristics of	eligible calls not identified These were checked for		Mortality at 28 days	(85.5%)vs.528 (73.8%)
		participants	selection bias but not		wortanty at 28 days	p<0.001
		Intervention vs. control	followed up. Scope of			Secondary outcomes
		Mean age (SD)	practice of paramedic			Secondary outcomes
		82.6(8.3) vs. 82.5(8.3) yrs	practitioners: Falls,			Subsequent unplanned
		Women %	Lacerations, Epistaxis, Minor			contact with secondary care
		72 vs.73%	burns, Foreign body in ear,			330(21.3%) vs. 259 (17.6%)
		Living in on own home %	nose, or throat, Local			p<0.01
		78vs.78 %	anaesthetic techniques,			
		Presenting complaint %	Wound care and suturing			Mortality at 28days
		Fall 88 vs.89%	techniques, Principles of			68(4.4%) vs.74(5%) p=0.41
		Haemorrhage 6 vs.5%	dressings and splintage,			
		Acute medical condition	Joint examination,			
		6vs.5%	Examination of neurological,			
			cardiovascular, and			
			respiratory system,			
			Examination of ear, nose, and throat, Protocol led			クリ
			dispensing: simple			
			analgesia, antibiotics,			
			tetanus toxoid, Assessment			
			of mobility and social needs,			
			Additional options for			
			referral and requesting			
			investigations, Requests for			
			radiography, Referral			
			processes: emergency			
			department, general			
			practitioner, district nurse,			
			community social services			

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Pag	e 45.0f 70	Study	Participants	Intervention	Control BMJ Ope	n <sub>Outcomes assessed</sub>	Results
Ī	Year						
	Country						
1 2 3 4 5	Gray 2008 UK	COS with historical controls Intervention: Emergency care practitioner (ECP) intervention	The study included two groups of patients a) those with breathing difficulties & b) elderly patients >65yrs with a fall. The latter only is reported here. Inclusion criteria:	Outline of intervention Jan-April 2006 inclusive, all the patients seen by the ECP service who had rung 999 and were an elderly patient (>65yrs) with a fall were	Outline of control Comparison data taken Jan- April 2005 inclusive for attendances to same ED for patients with the same criteria as	Relevant measures & outcomes Outcome on initial contact: Treated at and stayed home	ECP vs. ED Outcome on initial contact: Stayed at home (PC referral)/went home 171 vs. 369 (73% vs. 48% avoidable
6 7 8 9 10 11 12 13 14 15 16		n=233 <b>Control:</b> Historical control group from ED n=772	Elderly patients >65yrs with a fall. Exclusion criteria: None given Baseline characteristics of participants None given	reviewed. Each patient seen by an ECP was searched for in the hospital records for ED attendance or admissions in 72 h and 28 days following attendance by an ECP	above & seen by non-ECP ambulance service personnel. These dates were chosen because, during this time, the ECP service was not tasked to patients with breathing difficulties and Yorkshire Ambulance Service had only 12 operational ECPs during this comparison period compared with 24 whole-time equivalent	ED and or admitted At 72hrs & 28 days At home ED attendance Admission Costs None	admission rate) At 72hr: 21/171 (intervention grp) attended ED and or were admitted At 28 days: A further 19 (intervention grp) attended ED and or were admitted Avoidable admission rate (intervention grp) at 28 days was 56% (17% better) compared to control group
					operational ECPs	10/1	

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П					BMJ One	N <sub>Outcomes</sub> assessed	
	Author	Study	Participants	Intervention	Control Divis Ope	Outcomes assessed	Results
	Year						
-	Country						
1	Mason	COS	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	Discharged with no further
			Informed consent was obtained			outcomes	follow up by any health
2	2012	Intervention:	from all study participants prior to	No detail	No detail		professional
3		Five teams of Emergency	recruitment. Within each pair of			Using paired services	49.2 vs.12.4%
-	UK	Care Practitioners (ECP)	services all patients presenting				MD 36.8% (95% CI 26.7,46.8)
4		n= 256 for care home	with emergency or urgent			Primary outcomes	
5		cohort	complaints that were eligible to be				Urgently referred to hospital
6		Control:	seen by ECPs and presented to			% of patients	(both ED or direct admission)
7		Five usual care providers	either the intervention or the			Discharged following	22.7 vs. 87.6%
1		n=201 for care home	control services between May			consultation with no	MD -64.9% (95% CI
8		cohort	2006 and August 2007 were			further follow up by any	-71.8 ,58.0)
9			included in the trial.			health professional	
-			Exclusion criteria:				
10			No detail			Urgently referred to	Non-urgently referred to GP
11						hospital (both ED or direct	or community care
12			Baseline characteristics of			admission)	28.1vs. 0%
			participants				28.1% (22.6,33.7)
13			(no stats given)			Non-urgently referred to GP	
14			Care home cohort			or community care	Episode time from first
			Intervention vs. control				contact to discharge
15			Mean age			Secondary outcomes	median in mins (IQR)
16			83.5(10.40 vs. 84.5(8.5) yrs			(relevant ones only)	60 (40,80) vs. 39 (29,58)
17							Time ratio
			% Female			Episode time from first	1.36 (1.24,1.49)
18			68 vs.66%			contact to discharge	
19							
20			Clinical complaint %				
			Adult medical 30 vs.41 %				
21			Adult trauma 46 vs.13 %				
22			Elderly falls 23vs.46%				
23		1		I			
23							

## Page 47 of 70 ED Interventions (n=3)

### **BMJ Open**

	Author	Study	Participants	Intervention	Control	Outcomes assessed	Results
	Year						
1	Country						
2	Sun	RCT	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	Observation vs. s care
3			Patients aged≥ 50 years or older	Patients received	The syncope protocol was	outcomes	Inpatient
	2014	Intervention:	diagnosed with intermediate	continuous cardiac	not used. Contamination	Deimana	admission rates
4	USA	ED observation syncope protocol	syncope.	monitoring ≥ 12hrs. ≤2 serial cardiac troponin	between groups was minimized by being	Primary outcomes Inpatient admission rates	9 (15%) vs. 57 (92%) Relative rate 0.16 (95%Cl
5	USA	n=62	Exclusion criteria	tests approx. 6 hours	managed in distinct	Hospital LOS at indexed	0.09,0.29, p<0.001)
6		11-02	Patients with a serious condition:	apart to exclude acute	physical spaces by	visit	Hospital LOS at indexed visit
7		Control:	symptomatic arrhythmias,	MI. Rest echocardiogram	different clinical services.	VISIC	mean SD (hrs) 29 (15) vs.
		Normal In-patient	myocardial infarction, pulmonary	for patients with cardiac		Secondary outcomes	47hrs (34) (p<0.001)
8		admission	embolism, acute pulmonary	murmur, if not performed	Intervention delivered	30 day and 6mth serious	Serious events
9		n=62	edema, stroke, severe anaemia or	in previous 6mths.	by:	events	During hospital visit
10			blood loss requiring blood	Additional testing as	No detail		Death 0 vs. 0
			transfusion, sepsis, and major	required. Maximum stay		Index and 30 day hospital	Arrhythmia 2 vs. 2
11			traumatic injury.	in observation unit could		costs	Pacemaker insertion
12			Also: seizure, head trauma, or	not be more than 24hrs.		30 days changes in QoL	1vs.1
13			intoxication as reason for loss of	Observation protocol		30 day patient satisfaction	Syncope with bone fracture
14			consciousness; new/ baseline	patients who received a			2 vs.1
			cognitive impairment; do-not-	diagnosis detailed in			30 days recurrent syncope 1
15			resuscitate or do-not-intubate	exclusion list or had			vs 1
16			status; active chemotherapy and inability to speak either	pending tests at 24hrs were admitted			30 day serious outcomes after discharge 2 vs. 0
17			English/Spanish. Met high risk	High Risk Criteria			6mth serious outcomes
18			criteria.	Serious condition identified in			after hospital discharge
			Baseline characteristics of	the ED, History of ventricular			4 vs.5
19			participants	arrhythmia, Cardiac device			Costs \$ (SD)
20			Observation vs. control	with dysfunction, Exertional syncope, Presentation			At index visit
21			Mean(SD) or%	concerning for acute coronary			1,400(1,220) vs.2,420(3,930)
22			Mean age	syndrome, Severe cardiac			Within 30 days
			65 (11) vs. 64(11)	valve disease (e.g., aortic			1,800(2,150) vs.2,520(3,980)
23			% Female	stenosis <1 cm2), Known cardiac ejection faction <40%			Change in quality of life mean
24			53 vs. 48	Electrocardiogram findings of			SD
25			Syncope index complaint (vs near	QTc>500 mS,pre-excitation,			0 (0.2) vs. 0.03 (0.18)
			syncope)	non-sustained ventricular			Change in syncope functional
26			74vs. 61%	tachycardia, Emergency physician judgment			status
27			Congestive heart failure 2vs. 3%	Intermediate Risk Criteria No			-7.6(20.1) vs2.4(26.3) Patient satisfaction
28			Coronary artery disease	high risk features AND		· · · · · · · · · · · · · · · · · · ·	8.9(1.40 vs.9.3(0.9)
29			13vs.8%	No low risk features AND Clinical judgment by			0.5(1.10 \$5.5.5(0.5)
			Arrhythmia 8vs.6%	emergency physician that			
30			Syncope in previous yr	patient requires further			
31			16vs.21%	diagnostic evaluation			
32			Quality of well-being scale	Low Risk Symptoms consistent with orthostatic or			
33			0.55(0.15) vs. 0.55(0.14)	vasovagal syncope,			
			Syncope functional status	Emergency physician			
34			29((25) vs.25(26)	judgment that no further			
35			Syncope risk score	diagnostic evaluation is			
36			0.76 (0.840 vs.0.76 (0.67)	needed.			
37							

Author	Study	Participants	Intervention	Control BIVIJ Ope	<b>N</b> Outcomes assessed	Results
	Study	Participants	intervention		Outcomes assessed	Results
Year Country						
Benaiges	cos	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	Mean (SD)
			Patients assigned to DH if	At hospital discharge, CH	outcomes	DH vs.CH
2014	Intervention:	Patients with sustained	admitted to hospital	patients were scheduled	(no distinguishing between	Readmissions for diabetes (%)
	'Day hospital' (DH)	hyperglycemia (>300 mg/dL) for at	within DH opening hours	for a one-week follow-up	primary and secondary	1(1.6)vs. 5 (13.9)
Spain	n=64	least 3 days with or without	(week days 8 am -4 pm);	visit in outpatient clinic.	outcomes )	P=0.04
		ketosis	otherwise they were			Readmission for any cause (%)
	Control:		treated in ED and	Intervention delivered	At 3 mth follow up	4(6.3)vs.7(19.4) p=0.085
	Conventional		subsequently	by:		No. of outpatient visits (SE?)
	hospitalisation (CH)	Exclusion criteria	hospitalized.	Unclear but normal	[No. of mild or severe	5.0(2.2)vs. 2.5(2.0)
	n=36	Ketoacidosis (venous pH <7.31	After initial treatment of	outpatient staff	hypoglycemic episodes ]	p=0.012
		and/or HCO3 <22 mEq),	hyperglycemic crisis DH			No. of ER visits (SE?)?
		hyperosmolar crisis (glycemia >600	patients were scheduled		Readmissions for diabetes	0.2(0.6)vs.0.2(0.4)
		mg/dL and effective plasma	for follow-up visits at 24,		or unrelated cause	P=0.59
		osmolarity >320 mOsm/L),	72 hours, and 7 days to			Costs
		unstable hemodynamic status or	adjust treatment and to		[Nosocomial complications	Initial care
		need for ventilatory support,	complete their diabetes		]	580.2(489.1) vs.
		severe precipitating factors such as	education			2,013.6(790.4) p<0.001
		acute myocardial infarction,			No. of outpatient visits	<b>Complementary examinations</b>
		stroke, sepsis, social deprivation,	Patients were treated			123.7(276.3) vs. 281.3(188.1)
		and dependence for four or more	with same protocol for		No. of ER visits	p=0.007
		activities of daily living (Katz index	both DH and CH: this			Pharmacy
		>D).	included initial evaluation		[outcomes] not detailed as	12.8(95.6)vs. 20.3(24.8)
			with a blood test,		not relevant to our question	P=0.676
			urinalysis, chest			Outpatient visits
		Baseline characteristics of	radiograph to rule out			116.7(75.3) vs. 56.9(105.7)
		participants	underlying infectious		Costs	p=0.003
		(Stats shown if signif)	disease, and hourly			Readmissions (total)
		DH vs.CH	measurement of glycemia		Initial care	340.8(1190)vs.288.3(916.8)p=
		Age	and ketonemia.		Complementary	0.835
		80.3(4.8)vs. 80.6(4.6)yrs	Treatment included		examinations	Total
		Female	hydration as required, an		Pharmacy	1,345.1(793.6) vs.
		67 vs. 56%	insulin regimen with		Outpatient visits	2,212.4(982.5) p<0.001
		BMI	insulin, and oral		Readmissions	
		26.1(4.9)vs.25.5(5.1)	carbohydrate intake if		Total	
		Katz A&B	glucose levels were less			
		72.2vs.72.2%	than 250 mg/dL with		In euros	
		Charlson Index	persistent ketosis. If			
		3.2(2.0)vs. 3.3(1.7)	infection was diagnosed,			
		Family support	treatment was initiated.			
		88.1 vs.97.1%	Diabetes education was			
		Diabetes duration	delivered by specialist			
		14.4 (8.0) vs. 97.1 yrs	diabetes nurse with			
		Plus other specific diabetes	specific attention paid to			2712
		measures	dietary advice, physical			
		measures				
			activity, and recognition			
			of hypoglycemia.			
			Measurement of glycated			
			hemoglobin (HbA1c) and	1		
			clinical evaluation was			
			scheduled for 3 & 6 mths			
			for patients in both			
			groups			

49.0f 70	Study	Participants	Intervention	Control BMJ Ope	<b>N</b> Outcomes assessed	Results
Year						
Country						
Salvi	COS	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	CED vs. GED
	(secondary analysis)	Patients aged ≥ 65yrs were	No details beyond	Patients presenting to	outcomes	Mean duration (SD)
2008	. , , , ,	enrolled in June 2006 from the	ED plus observation unit of	ED were screened		6.2(4.5) hrs vs. 12.8 (8.5) h
	Intervention:	GED and July 2006 from the CED	6 beds	Mon-Fri 9am- 6pm	Mean duration (SD)	P<0.001
Italy	Geriatric ED (GED)	taking care that none presenting		using standard	. ,	No. of initial admissions
	n=100	to the ED in the course of the	Intervention delivered by:	information sheet.	No. of initial admissions	53 vs.63 p=0.2
		study period was recruited again.	No details	Interviews conducted	-	LOS in days
	Control:	,,		with patients or family	LOS in hospital days	10(6.65) vs. 10.5(7.2) p=0.
	Conventional ED (CED)	Exclusion criteria		member/other for		No. ED visits
	n=100	Cognitive impairment		patients with cognitive	Both of above presented as	30 davs
		(a score of $\geq 5$ on the Short		impairment. Written	baseline data	25 vs. 23 visits p=0.88
		Portable Mental Status		consent & access to		6months
		Questionnaire SPMSQ )		medical records was	No. ED visits at 30 days and	51 vs. 42 p=0.25
		and no proxy,		obtained. patients a	6 mths	Frequent ED return (≥3 vis
		Those too ill to respond, Trauma		underwent a brief	0	over 6 mths)
		patients		geriatric assessment	Frequent ED return (≥3	11 vs.13 visits p=0.84
		patiento		using the Charlson	visits over 6 mths)	No. hospital admissions a
		Baseline characteristics of		Index, SPMSQ, and		6mths
		participants		ADL before the current	No. hospital admissions at	36 vs.29 p=0.2
		CED vs GED		event	6mths	ADL 20 vs. 20 p=0.34
		Mean(SD)		event	ommis	Mortality
		Age 78.1(7) vs.82.5(7.20 p<0.001			ADL at 6mths (defined as	30 days 8 vs. 5 deaths
		Female 47 vs. 68% p<0.001			functional decline	6months 20 vs. 19
		Married 70 vs. 40% p<0.001			junctional accine	Statistically significant at
		Living alone 12 vs 14			Mortality at 30 days & 6	6mths after adjustment fo
		Triage code			mths	age, sex, living status,
		Urgent/semi-urgent (2/3)			intens	admission at time of
		97 vs.90 %				recruitment Charlson inde
		Charlson Index 3.3(2.3) vs. 3.4(1.7)			Costs	SPMSQ and ADL
		SPMSQ			None	p=0.047
		2.5(3.3) vs. 5.2(4.2) p<0.001			None	p=0.047
		ADL4.3(2) vs. 3.2(2.5)				
		P=0.001				
		1-0.001				
		No differences in profile of				
		diagnosis in ED between groups				
		diagnosis in ED between groups				

### *Community hospital (n=2)*

Author Year	Study	Participants	Intervention	Control	Outcomes assessed	Results
Country						
Garåsen	RCT	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	CH vs. GH No. (%)
		Patients aged ≥60 years admitted	On admission to CH the	The care at different	outcomes	At 26 weeks
2007/8ab	Intervention:	to general hospital due to acute	physicians	departments at GH and		No. of readmission for inde
	Community hospital (CH)	illness or acute exacerbation of	performed a medical	communication with	Follow up at 26 weeks & 12	disease
	n=72 assigned but 8 went	known chronic disease	examination of the patients	primary health care	months	14(19%) vs. 25 (36%) p=0.0
Norway	on to GH		and a	followed the standard		Need for community home
		Probably in need of in ward care	careful evaluation of	routines through the	No. of readmission for	care
	Control:	for ≥ 3-4 days	available earlier health	formal organisation.	index disease	38(53%) vs. 44(63%) p=0.3
	General hospital		records from			Need for long term nursing
	(GH) admission	Admitted from own homes and	the admitting general		Need for community home	home
	n=70	expected to return home when	practitioner, the general		care	7(10%) vs. 5(7%)
		care finished.	hospital physicians and the			p= 0.76
			community home care		Need for long term nursing	No. days in institutions
		Exclusion criteria	services. The		home	31(95% Cl 26.1,34.7) vs.29
		Severe dementia or a psychiatric	communication with each			(95% CI 23.2,36.4) p=0.80
		disorders needing specialised care	patient and his family		No. of days in institutions	No. of deaths
		24 hours a day.	focusing on physical and		after randomisation	9(12.5%) vs14(20%) p=0.15
			mental challenges was also		[intervention +rehab	No. days before death
		Baseline characteristics of	essential to understand the		+readmissions] data is	165 (95% CI 154-176) vs. 1
		participants	needs and level of care.		available for separate	(95% CI 144,165)
		(No stats given)			services	No care
		[including data from	Assume from the inclusion		No. of double	18(25%) vs. 7(10%) p=0.02
		n=8 who were assigned CH then	criteria that all patients		No. of deaths	12 month data
		went to GH]	came to the general hospital		No of drive bofore doubt	No. of deaths
		CH vs.GH	initially then		No. of days before death	13(18.1%) vs. 22 (31.4%) p=0.03
		Age	' When an eligible patient		No care	Total observation period
		80.6 (0.8)vs. 81.3(0.8)yrs	was identified and accepted		No cure	335.7(95% CI 312.0,359.4)
		Female	for inclusion, a blinded		12 month data in [0273]	292.8(95%CI 264.1,321.5)
		72 vs.61%	randomisation was		12 month data in [0273]	days p=0.01
		Living with spouse	performed by the			uays p=0.01
		16 vs. 15	Clinical Research		Costs	
		ADL (SD)	Department at the Faculty		None	
		2.24(0.9) vs. 2.05 (0.7)	of Medicine.'			
		Primary diagnosis	of medicine.			
		Cardio dis 31 vs.29%	All patients randomised for			
		Infect 18vs. 23%	care at the community			
		Fractures/contusions	hospital were transferred			
		19vs. 17%	from the general			
		Pulmonary disease	hospital within 24 hours			
		7vs.9%	after the time of inclusion to			
		Neurological 7 vs.6%	the study and immediately			りな
		Cancer 3 vs 6%	after the time of			
		Psychiatric 1vs.0%	randomisation.			
		<b>Other</b> 14 vs 11%				
	1		1	1		1

Page 51th 70	Study	Participants	Intervention	Control BMJ Ope	N <sub>Outcomes</sub> assessed	Results
Year Country						
1       Vicente         2       2014         3       Sweden         4       5         6       7         8       9         10       11         12       13         14       15         16       17         18       19         20       21         22       23         24       25         26       27         28	RCT Intervention: Going to a community- based hospital n=410 Control: Going to ED n=396	Inclusion criteria: No specific information Exclusion criteria: No specific information older adults were randomized when they called the emergency number Baseline characteristics of participants Intervention vs. control Mean age (SD) 81 (8) vs. 81(8) yrs % Female 56 vs. 59% Priority level when ambulance sent out (% individuals) 1. 1.6 vs. 0% 2. 59 vs. 47 % 3. 39 vs.53% P=0.001 Priority level when ambulance arrives at hospital (% individuals) 1. 7.2 vs.3.6% 2. 39 vs.35% 3.54 vs.61%	Outline of intervention The study was conducted over 14 months from Oct 2008 to Dec 2009. Two EMS companies were included in the study. Ambulance personnel at Company 1 had training in and access to the system and tool and could triage eligible individuals to a GW or, a CECC at a CH. By following system and tool & after assessment of the individual's medical situation and care needs, the ambulance nurse was able to decide whether the individual required full ED services or would benefit more from being transported to an assessment at the CH instead. Delivered by: The ambulance nurse education are required to have a course of 60 credits includes ≥ 30 credits in Caring Science. The criterion for entering this program is a BSC Caring Science and Nursing. Since 2007, a 1-year Master's Degree & postgraduate Diploma in Specialist Nursing, Prehospital Emergency Care Program has been available.	Outline of control Ambulance personnel at Company 2 had no training in the system and tool, and transported all individuals to a full- service ED at a tertiary hospital	Relevant measures & outcomes Primary outcome: No. of individuals sent direct to CH for either to GW or CECC Secondary outcome: No. of subsequent transfers from CH to ED within 24 hrs Calculated as Intention to treat (ITT) and per protocol (pp) analysis Costs None	Intervention vs. control No. of individuals sent direct to CH for either to GW or CECC ITT 90/449 20% (16.6,24) PP 56/273 20.5% (16.1,25.7) No. of subsequent transfers from CH to ED within 24 hrs ITT 6/90 6.7% (3.1,13.8) PP 4/56 7.1 (2.8,17.0)
29 30 31 32 33 34 35 36 37 38 39			·	<u>.</u>		

### *Hospital at home for community dwelling older people (n=9)*

 BMJ Open

j	Author	Study	Participants	Intervention	Control	Outcomes assessed	Results
1	Year						
2	Country Patel	pilot RCT	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	There was no significant
3	2008	Intervention: HC	Into study Earlier diagnosed with CHF with diastolic	Initially treated in the ED for	Treated in hospital as	outcomes	difference in clinical events including readmissions
4	Sweden	Treated at home after	or systolic LVD	≥48 h & then sent home.	per hospital treatment	No distinction between	adverse events or in HRQL
5		>48hrs treatment in ED	Deterioration of HF ≥3 days with symptoms of increasing dyspnoea,	The specialist HF nurses	guidelines	primary and secondary	(measured at baseline too).
6	Heart Failure	(n=13)	orthopnoea, weight gain≥2 kg, debuting	followed a written physician		outcomes	
7		Control: CC Treated in hospital as per	peripheral oedema or abdominal swelling Clinical signs, e.g., extended	directed care plan including adjusting medications. A		Clinical status was	The total cost related to CHF
8		hospital treatment	jugular vein, leg oedema, tachypnoea,	cardiologist could be		documented at 1,4,8& 12	was lower in the HC
9		guidelines (n=18)	pulmonary rales, ascites and third heart	consulted. All patients		mths	group after 12 months
			sound. At least one symptom and one sign should be present	followed-up one day after			(p=0.05)
10			New York Heart Association class II–IV	returning home by nurse.		Direct costs for control	detail of costs Euros HC vs. CC
11			for home treatment	The patients were visited daily or every other day for		group based on compensation paid to	Nurse cost 386 (244-1107) vs.
12			It was considered medically safe to treat patients at home if they had a S-	5–7 days as appropriate.		hospital and for home care	N/A
13			Potassium level 3.4-5.5 mmol/L, systolic	The home visits stopped		group based on time &	Physician 35(19-74) vs. N/A
14			blood pressure >95 mm Hg, S Creatinine<250 μmol/L & <50% increase	when: (1) was		activities of nurses &	Transport 96953-127) vs. N/A
15			from the baseline value during drug	symptomatically stable or		physicians plus lab tests	Total cost for care
16			adjustment.	improving, (2) had stable or falling		and i.v diuretic episodes	586 (334-1125) vs. 3277 (2125-5750)
17			Exclusion criteria Unwillingness to participate	weight, (3) had no signs of		Readmissions from hospital	(2225 5755)
			Worsening of CHF<3 days	pulmonary rales and (4) had		data ( presumably up to	Readmissions
18			Newly onset HF, Pulmonary or pre-	no oedema above the ankle.		12mths – not listed in	0.5(0.8) vs. 0.6 (0.8) ns
19			pulmonary oedema, Need for monitoring of arrhythmia	Patients could contact nurse by phone in office hours.		methods)	
20			Other morbidities indicating need for	Nurses at intensive cardiac			
21			hospitalisation. Living at an institution. Inability to follow instructionsS-	care unit could be reached			
22			Haemoglobinb100 g/L or a decrease of S	by telephone after office			
23			Haemoglobin>20 g/L S-Creatinine>250 μmol/L	hours. A cardiologist was			
24			S-Potassium>5.5 mmol/L or b3.4 mmol/L	always available for phone consultation ≤1 month after			
24 25			S-Troponin T>0.05 μg/L	the last home visit, the			
			Creatine kinase-MB>5 µg/L ASAT and ALAT>three times above the	nurse was available for			
26			normal value. Systolic blood pressure>95	phone counselling.			
27			mm Hg Heart rate<45 or >110 beats/min Baseline characteristics of				
28			participants				
29			Male n (%) 6 (46)/7 (54) 15 (83)/3 (17)				
30			0.03 Age (years) mean (SD) 77 (10) 78 (8) ns Marital status n (%) Divorced 2 (15) 3				
31			(17) ns Single 1 (8) 2 (11) ns Widowed 7				
32			(54) 5 (28) ns Education n (%) ≥9 years 1				
32 33			(8) 8 (44) 0.02 ns Weight kg mean (SD) 71 (13) 79 (15) ns NT-proBNP pg/ml				2712
			(median and interquartile range) 4420				
34			(1690–14350) 9335 (3375–13350) ns LVEF % mean (SD) 36 (13) 33 (12)				
35			Preserved ejection fraction CHF n (%) 3				
36			(23) 2 (11) Systolic CHF n (%) 10 (77) 16				
37			(89) NYHA class n (%)II 1 (5.5)III 13 (100) 16 (89) IV 1 (5.5)				
38			truncated				
39							
09							

e 5 <u>3 no</u> f 70	Study	Participants	Intervention	Control BINIJ Ope	N <sub>Outcomes</sub> assessed	Results
Year Country						
Mendoza	RCT	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	Clinical outcomes were simila
2009		Patient of 65 years and over			outcomes	after initial admission and als
Garcia-	Intervention:	With diagnosis and prognosis	Characteristics of the HaH	Patients were admitted		after the 12 months of follow
Soleto	Hospital at home (HAH)	evaluation of HF since at least 12	unit explained whilst still in	to hospital, cardiology	No distinction between	up.
2013	care (n=37)	months prior to the study	ED. Given information sheet	ward & were managed	primary and secondary	
2013	Control:	NYHA functional class II or III	with contact phone	by the usual staff of	outcomes	
Spain	Inpatient hospital care	before coming to ED due to	numbers. Within 12–24 h of	cardiology specialists	outcomes	Death or re-admission due t
Spain		Ū.		and nurses, in	Effectiveness	HF or a cardiovascular even
	(IHC) in a cardiology unit	exacerbation	the ED visit, patients	,		
Heart Failure	(n=34)	Exclusion criteria	received scheduled & if	accordance with	Necessity to transfer the	occurred in 19 patients in II
Heart Failure		Admitted in the preceding 2	necessary, urgent visits to	guidelines.	patient from HaH to IHC	and 20 in HaH (P=0.88).
		months for deterioration of HF or	their homes from an		during the first admission	
		acute coronary syndrome	internal medicine specialist		Mortality due to any cause,	Changes in functional statu
		Presence of severe symptoms such	& a nurse, (staff of the HaH		re-admission due to HF, or	and health-related quality of
		as sudden worsening of HF	unit). If deterioration		another cardiovascular	life over the follow-up perio
		Poor prognosis factors	occurred outside the		event (stroke, acute	were not significantly
		(haemodynamic instability, severe	working hours (8am-9 pm		coronary syndrome, and	different.
		arrhythmia, baseline creatinine	every day of yr), patients &		coronary revascularization)	
		above 2.5 mg/dL)	family were instructed to		during 1 year of follow-up.	Average cost
		No response to treatment in the	call 112 to explain they		Functional status -Barthel	of initial admission
		ED	were HaH patients.		index	4502±2153E in IHC and
		Active cancer, severe dementia, or	Samples were taken for lab		Health-related quality of life	2541±1334E in HaH (P< 0.0
		any other disease at an advanced	tests and ECGs were		-SF-36 since first admission	
		stage indicating life expectancy of	performed in patient's		up to 12 months later	During 12 months of
		less than 6 months	home			follow-up, the average
		Acute psychiatric diseases, active	nome			expenditure was 4619+767
		alcoholism	X-ray & echocardiography at		Costs	and 3425+4948E (P= 0.83)
			hospital was as		Cost of the stay	. ,
		Active pulmonary tuberculosis				respectively.
		Those living in a psycho-geriatric	accessible for HaH patients		Medication, diagnostic tests	
		institution	as for in-patients. Generally		(electrocardiography,	
		No guarantee of all-day	all patients were visited		echocardiography,	
		supervision	daily by a specialist nurse.		laboratory tests, and chest	
		Absence of a telephone at home or	Patients were visited by a		X-ray), consumables, and	
		living more than 10 km from the	physician daily or every		transport.	
		hospital	other day depending on		visits to HF clinic, primary	
		Baseline characteristics of	condition. Treatment in HaH		care physician or ED, as well	
		participants IHC vs. HaH	finished with referral to		as re-admissions.	
		Women, n (%) 10 (29.4) 19 (51.4)	primary care after		For re-hospitalizations, the	
		0.06 Age, mean +SD 79.9+6.3	recovery or, in case of		cost of the admission was	
		78.1+6.2 0.20 Admissions for HF in	deterioration or no		estimated as the average	
		previous year 0.41+0.86 0.65+0.86	response to treatment, with		cost per day incurred during	
		0.13 O2 saturation in ED 91.4+5.2	transfer to the cardiology		the first admission for each	りょ
		93.2+4.6 0.12 Functional Class	ward.		group.	
		NYHA II, n (%) 23 (67.6) 19 (51.4)				
		Functional Class NYHA				
		III, n (%) 11 (32.4) 18 (48.6) 0.16				
		Atrial fibrillation, n (%) 16 (47) 21				
		(56.8) 0.49 LVEF ≥45%, n (%) 24				
		(70) 23 (62.1) LVEF , <45%, n (%)				
		10 (29.4) 14 (37.8) 0.13 NT-proBNP				
		(pg/mL) 4056+5352 3864+3720				
		0.86 Charlson index 2.1+1.3				
		2.5+1.5 0.35	1			1

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Author	Study	Participants	Intervention	Control DIVIJ Ope	<b>N</b> Outcomes assessed	Results
Year						
Country						
Tibaldi	single blind RCT	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	Primary outcomes
2009		≥75 years with a pre-existing	The team has 7 cars, is	The inpatient control	outcomes	Patient mortality at 6 months
Italy	Intervention:	diagnosis of CHF (stage C AHA) &	multidisciplinary and	group (GMW) received		was 15% in the total sample,
	Physician led - Geriatric	persistent functional impairment	consists: 4 geriatricians, 13	routine hospital	Primary outcome	without significant difference
Heart Failure	Home Hospitalization	indicative of NYHA class III or IV	nurses, 3 physio-therapists,	care. Protocols for	Mortality at 6 months.	between the 2 settings of car
	Service (GHHS; n=48)	status presenting at hospital ED	1 social worker &1	prevention of	Secondary outcomes	(7 vs. 8 deaths)
	Canatarali	for acute decompensation	counselor working together	nosocomial infections,	morbidity (infections,	Secondary outcomes
	Control: Patients were randomly	(defined )& in need of hospital	as a team, with daily meetings	bed	delirium, bed sores, deep vein thrombosis, and	The number of subsequent
	assigned to the general	care. Additional inclusion criteria	7 days a week. In ED all	sores, and immobilization are	falls) during hospitalization,	hospital admissions was not statistically different
	medical ward (GMW;	were appropriate care supervision at home, telephone connection,	necessary diagnostic	routinely adopted for	admissions to a nursing	in the 2 groups
	n=53)	living in the hospital at- home	tests are provided and then	frail elderly	home, and subsequent	8 (17%) vs. 18 (34%)
	11-33)	catchment area, informed consent,	the patient moves home by	inpatients.	hospital admissions	8 (17%) VS. 18 (34%)
		at least 1 previous admission for	ambulance, usually within a	inpatients.	related to any cause	mean (SD) time to first
		acute CHF, and need for	few hours. Medical		I CIALEU LU AITY LAUSE	additional admission was
		intravenous drug infusion.	consultation with other			longer for the GHHS patients
		Exclusion criteria	hospital specialists			(84.3 [22.2] days vs
		New-onset heart failure; absence	is possible in the hospital or			69.8[36.2] days, P=.02).
		of family and social support; need	at the home of the patient.			
		for mechanical ventilation,	Treatments included			Only the GHHS patients
		hemodialysis, or intensive	physician and nurse visits,			experienced improvements
		monitoring; severe dementia ;	standard blood tests, pulse			Depression (GDS) +1.48 (1.8
		terminal malignant neoplasm;	oximetry, spirometry,			vs. +0.12 (3.36) p=0.02)
		severe renal impairment; hepatic	electrocardiography,			nutritional status (MNA) -
		failure; serum hemoglobin level	echocardiography etc (as			0.86(1.12) vs0.27 (1.78)
		less than 9 g/dL; and planned	per hospital) Patients			p=0.05
		cardiac surgery(eg, valve	treated at home and family			Quality-of-life(NHP) +1.09
		replacement).	members obtained			(2.57 vs. +0.18 (1.94) p=0.04
		Baseline characteristics of	adequate Education e.g.			
		participants	early recognition of			
		Long list of demographic & clinical	symptoms. Protocols for			
		baseline – truncated	prevention of nosocomial			
		GHHS vs. GMV	infections, bed sores, and			
		Mean age 82.2 (5.2) vs. 80.1(4.9)	immobilization are routinely			
		p=0.04	adopted for frail elderly			
		Male (%) 22(46) vs. 30 (57)	inpatients. In the first days			
		Married (%) 22 (46) vs. 24 (45)	after admission to GHHS			
		Family support at home (%)	patient was visited at home			
		48(100) vs. 53(100)	on a daily basis by			
		Length of disease (yr) 5.4 (4.7) vs. 5.2 (4.7) plus clinical symptoms	physicians and nurses. In the following days this care		ien.	275
		both cardiovascular & general	is tapered off as appropriate			
		including functional status	Consultation with			
		(Barthel index) depression (GDS)	cardiologists or other			
		MMSE, MNA, comorbidity	hospital specialists was			
		measured by CIRS 3.6 (1) vs. 3.4	possible. Physicians and			
		(2) All ns except age	nurses were available at all			
		(=, , to except uBe	times for urgent home			
			visits.			

Pac	je <u>55. of</u> 70	Study	Deuticineute	Intervention	Control BMJ Ope	n <sub>Outcomes assessed</sub>	Desults
	Year	Study	Participants	Intervention	Control Dine Ope	•Outcomes assessed	Results
	Country						
	Ricauda	Single blind RCT	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	Primary outcomes
1		-	Patients ≥75 yrs with a diagnosis of	Intervention delivered by;	Intervention delivered	outcomes	GHHS vs. GMW
2	2008	Intervention:	acute exacerbation of COPD,	"a physician-led	by:		Hospital readmissions at6mths
3		Geriatric home	defined on Anthonisen criteria as	substitutive hospital-at-	The inpatient control	Primary outcomes	42% vs 87%, P= 0.001
4	Italy	hospitalization service	an increase in breathlessness,	home model of care"	group received routine	Hospital readmission &	Cumulative mortality at 6 mths
5	COPD	(GHHS, n=52)	sputum volume, or purulence for at least 24 hours, admitted to the	Patients assigned to HaH	hospital care	mortality rates at 6 months.	was 20.2% in the total sample, No significant differences
	COPD	Control:	ED & requiring hospitalization.	were immediately			between grps.
6		General medical ward	Additional inclusion criteria were	transferred home by		Secondary outcomes Depression status -Geriatric	between gips.
7		(GMW, n=52)	appropriate care supervision in the	ambulance. At		Depression Scale, functional	Secondary outcomes
8			home, telephone connection,	home, a multi-dimensional		status- Katz activities	Mean length of stay
9			living in the HaH & informed	geriatric assessment was		of daily living	15.5 ±9.5 vs 11.0 ± 7.9 days, P=
			consent.	conducted & patients		& Lawton instrumental	0.010
10			Exclusion criteria	received hospital-level		activities of daily	Only GHHS patients
11			Absence of family and social support; severe hypoxemia (partial	treatment& services, as their condition dictated.		living	experienced improvements in depression and QoL
12			pressure of oxygen <50 mmHg);	(Physician and nursing visits,		Cognitive status -Mini-	scores but ns between grps
13			severe acidosis or alkalosis (pH	standard blood tests, pulse		Mental State Examination, Quality of life -the	There were no differences in
14			<7.35 or >7.55); suspected	oximetry,		Nottingham Health	functional, cognitive,
15			pulmonary embolism; suspected	electrocardiogram,		Profile	nutritional, or caregiver
			myocardial infarction; severe	spirometry, echocardiogram,		Nutritional status -Mini	burden outcomes.
16			comorbid illness as defined by	echographs and Doppler		Nutritional Assessment,	Satisfaction at discharge was
17			presence of need for hemodialysis, severe renal impairment	ultrasonographs,oral & intravenous medication		Caregiver characteristics -	very good or excellent for 94% vs. 88% (P=0.83)
18			(glomerular filtration rate <20	administration, including		Relatives' Stress Scale, &	(On a cost per patient per day
19			mL/min), cancer (except skin	antimicrobials & cytotoxic		satisfaction using ad hoc questionnaire for	basis,
20			cancer), hepatic failure, or severe	drugs, oxygen therapy,		Scale.	(\$101.4 ± 61.3 vs \$151.7 ±
			dementia (Mini-Mental State	blood products transfusion,		Costs of care were	96.4, P=0.002).
21			Examination score <14).	central venous access,		compared for the acute	
22			Baseline characteristics of	surgical treatment of		episode.	
23			participants Intervention vs. control	pressure sores, physical therapy & occupational			
24			Age, mean $\pm$ SD 80.1 $\pm$ 3.2 79.2 $\pm$	therapy			
25			3.1p=0 .20 Male, n (%) 29 (56) 39	The HaH program			
			(75) p=0.06 Married, n (%) 27 (52)	emphasized			
26			29 (56) .84 Family support n (%) 52	patient & caregiver			
27			(100) 52 (100) p=0.89 Current	education about the			
28			smoker, n (%)7(13)6(11) p=0.97Ex-	knowledge of the disease,			2712
29			smoker, n (%) 34 (65) 35 (67) p=0.95 FEV1, mean ±SD 0.92 ±0.4	giving advice about smoking cessation,			
30			$1.04 \pm 0.5 \text{ p}=0.18 \%$ of predicted	nutrition, management of			
			FEV1 38, 47 Home oxygen use,	activities of daily living &			
31			n(%)18 (35)12 (23) p=0.45 Arterial	energy conservation,			
32			blood gas, mean $\pm$ SD pH 7.40 $\pm$	understanding & use of			
33			0.04 7.41 ± 0.03 .19 PP of O <sub>2</sub> 69 ±	drugs, health maintenance,			
34			19 65 ±±14 .p= 0.23 PP of CO <sub>2</sub> 44 ±	& early recognition of			
35			12 46 ± 12 .47 ADL score, mean ± SD± 2.3 ± 2.2 1.9 ± 2.2 p=0.36 IADL	triggers of exacerbation that required medical			
			score, mean $\pm$ SD 7.1 $\pm$ 4.9 8.1 $\pm$	intervention.			
36			4.2 .27 GDS score, mean ± SD 16.1				
37			± 6.1 17.2 ± 6.8 .45 Comorbidity				
38			index 2.6 ± 1.5 3.0 ± 1.8 p=0.24				
39							
40							

				BM.I One	n Outcomes assessed	
Author	Study	Participants	Intervention	Control BIVIJ Ope	Outcomes assessed	Results
Year Country						
Rodriguez-	COS	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	All comparisons ns
Cerillo	203	For trial	outline of intervention		outcomes	
	Intervention:	Non-massive pulmonary embolism	No detail	No detail		Mean stay length HH vs. CH
2009	Home hospitalization (HH)	<ul> <li>No contraindications</li> </ul>			No distinction between	8.9 days (7–14 days), vs. 10.6
	(n=30)	for treatment with			Primary and secondary	days (6-20 days).
Spain		low MW heparin			outcomes	
	Control:	Absence of moderate				All patients in study had a
non-massive	Conventional	to severe renal failure			Major and minor bleeding	favourable clinical
Pulmonary	Hospitalization (CH)	Haemodynamic			Re-thrombosis,	course.
embolism	(n=31)	stability			Clinical course	
		<ul> <li>O2 saturation higher</li> </ul>			Unexpected returns to	No major bleeding, re-
		than 92% breathing			hospital	thrombosis, or death
		room air			Need for hospital	occurred.
		No signs of heart			re-admission in the	One patient on IIII
		failure			following 3 months.	One patient on HH experienced an abdominal
		No arrhythmia				wall haematoma in the area
		No haemoptysis				of administration of the low
		For HH				MW heparin.
		Agreement to				
		admission to our HH				One patient
		unit				admitted to hospital
		<ul> <li>A valid caregiver at home</li> </ul>				experienced a haematoma in
		Residence in our				the right arm related
		health area				to blood sampling for
		A condition amenable				laboratory tests.
		to home management				
		Exclusion criteria				No patient with HH had
		massive PE, haemodynamic				infectious complications.
		instability, oxygen saturation				Three patients admitted to
		lower than 92% on room air, heart				hospital were diagnosed of
		failure, haemoptysis, arrhythmia &				urinary tract infection.
		contraindication for treatment				No IIII potients
		with low MW heparin				No HH patients required
		Baseline characteristics of				unexpected return to hospital during admission.
		participants				during aumission.
		Age 66.8 (27–91) 66.7 (31–90) n.s				During follow-up, two patients
		Sex (males) 30% 54.8% n.s			_	required hospital admission,
		Diagnosed neoplasm 13.3% 9.7%				one in each group. The cause
		n.s Associated DVT 40% 29% n.s				was not related to the
		Prior TED 0% 19.3% 0.05				thromboembolic disease.
		Dementia 23.3% 6.4% n.s.				
		Hypertension 30% 45.1% n.s.				
		Ischaemic heart disease 6.6% 9.6% n.s. Thrombophilia 3.3% 0% n.s				
		Recent surgery 3.3% 6.4% n.s				
		Unilateral involvement 70% 61.3%				
		n.s Bilateral involvement 30%				
		38.7% n.s Diagnosed by helical CT				
		26.6% 38.7% n.s				
	1		1	1	1	1

Pag	e 57, of 70	Study	Participants	Intervention	Control BMJ Ope	N <sub>Outcomes</sub> assessed	Results
	Year						
_	Country Carratala	Open RCT	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	Intervention vs. control
1	Carratala	Open KC1	All immunocompetent patients	Outpatients were given oral	Hospitalized patients	outcomes	Intervention vs. control
2	2005	Intervention:	who were at least 18 years of age	levofloxacin	received sequential	outcomes	
3		Outpatient care with oral	and had received a diagnosis of	(500 mg/d), and	intravenous and oral	Primary outcomes	Primary outcome
	Spain	levofloxacin therapy or	community acquired	received detailed written	levofloxacin (500 m	% of patients with an overall	Successful outcome was
4		hospitalization with	pneumonia in the emergency	information about their	and received detailed	successful outcome at the	achieved in 83.6 vs. 80.7%
5	_	sequential intravenous	department (24 hrs per day, 7 days	pneumonia diagnosis and	written information	end of treatment, according	(absolute difference, 2.9 %
6	Pneumonia	and oral levofloxacin	per week)	their treatment plan, as well	about their pneumonia	to 7 predefined criteria:	points [95% Cl, ±7.1 to 12.9 %
7		therapy. (n=110)	Community acquired pneumonia	as emergency contact telephone numbers	diagnosis and their treatment plan, as well	cure of pneumonia (as defined later), absence of	points]). % patients with adverse drug
8		Control:	was defined as the presence of a	for a nurse or investigator	as emergency	adverse drug reactions,	reactions (9.1% vs. 9.6%),
		Hospitalisation (n=114)	new infiltrate on chest radiography	physician.	contact telephone	absence of medical	Subsequent hospital
9			plus at least 1 of the following:	Patients were visited at	numbers for a nurse or	complications during	admissions
10			fever (temperature ≥38.0 °C) or	home by a nurse 48 hours	investigator physician	treatment, no need for	(6.3% vs. 7.0%),
11			hypothermia (temperature <35.0	after emergency	g/d) Patients assigned	additional visits, no changes	Overall mortality (0.9% vs. 0%)
12			°C), new cough with or without	department discharge. The	to hospitalization were	in initial treatment with levofloxacin, <b>absence of</b>	Medical complications
13			sputum production, pleuritic chest pain, dyspnea, or altered breath	visit included assessment of vital signs and	seen daily during their hospital stay by	subsequent hospital	(0.9% vs. 2.6%),
				measurement of oxygen	attending physicians	admission in the 30	Secondary outcomes
14			sounds on auscultation.	saturation by pulse	and by at least 1 of the	days after randomization,	All ns
15				oximetry. If	investigators. Criteria	and absence of death from	Quality of life
16			Neutropenia, HIV infection,	the nurse thought that a	for early switching	any cause in the 30 days	(9.1% vs. 9.6%)
17			transplantation, or splenectomy or	patient's condition was not	from intravenous to oral levofloxacin	after randomization.	Satisfied with overall care (91.2% vs. 79.1%; absolute
18			who were taking	improving (worsening of baseline vital	were a respiratory rate	Secondary outcomes	difference, 12.1% [Cl, 1.8 to
19			immunosuppressive	signs, oxygen saturation, or	of 24	Patients' quality of life &	22.5 % points]).
			drugs	both), one of the	breaths/min or less, a	satisfaction	
20			Baseline characteristics of	investigators made an	pulse rate of 100		
21			participants	additional visit. The nurse	beats/min or less, a		
22			Male 69 (62.7) 66 (57.9)	was involved only in	temp of 37.8 °C or		
23			Female 41 (37.3) 48 (42.1)	outcome assessment. Patients were seen at the	lower on 2 occasions at least 8 hours apart,		
24			Mean age ± SD, y 67.5 ± 11.8 64.9	outpatient clinic at days 7	and maintenance of		
25			± 13.4 Alcohol consumption ±80 g/d, n	and 30 after pneumonia	adequate oral intake.		
			(%) 13 (12.4) 7 (6.4)	diagnosis.	Physicians		
26			Current tobacco smoking, n (%)‡		were advised to		
27			21 (19.8) 24 (21.8)		discharge patients after their clinical		
28			Influenza vaccine in current		condition stabilized, in		
29			season, n (%)§ 44 (42.7) 49 (46.2)		accordance with		
30			Pneumococcal vaccine in the previous 5 yrs, <i>n</i> (%)± 15 (15.6) 13		previously		
31			(13.1)		recommended criteria.		
32			Comorbid conditions, <i>n</i> (%) 71		Patients were seen at		
			(64.5) 78 (68.4)		the outpatient clinic at days 7 and 30 after		
33			Mean oxygen saturation ± SD, %		pneumonia diagnosis.		2712
34			$94.5 \pm 2.094.5 \pm 1.8$		Fileditionia diagnosisi		
35			Multilobar pneumonia, n (%) 8 (7.3) 9 (7.9)				
36			Risk class, <i>n</i> (%) II 55 (50.0) 63				
37			(55.3) III 55 (50.0) 51 (44.7)				
			Mean PSI score ± SD 70.0 ± 11.6				
38			66.9 ± 12.5				
39							

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ſ	Author	Study	Participants	Intervention	Control BMJ Ope	n Outcomes assessed	Results
	Year	Study	Tarticipants	intervention		outcomes assessed	hesuits
	Country						
1	Kalra	RCT	Patients were included within 72	Outline of intervention	Outline of control	Relevant measures &	Mortality and
			hours of stroke onset. The	ST Patients were managed on general wards & under care of	SU	outcomes	institutionalisation at 1yr were
2	2005	Intervention:	research team was notified by	admitting physicians. All patients	Care was provided by a	Duiment outcomes	lower on SU vs.ST or DC
3	UK	1)ST (n=152) The stroke team involved	telephone or fax by GPs for patients at home, and by accident	were seen by specialist team:	stroke physician supported by a	<i>Primary outcomes</i> Death or	Significantly fewer patients on
4	ÖK	management on	and emergency (A&E) services for	doctor (specialist registrar grade), a nurse (grade G), a	multidisciplinary team	institutionalisation at 1	SU died compared with ST
5	Stroke	general wards with	suspected stroke patients	physiotherapist (senior I) and an	with specialist	year.	
6		specialist team support.	presenting to the casualty	occupational therapist (senior I)	experience		The proportion of patients
		The team undertook	department.	with expertise in stroke management. Patients were	in stroke management.	Dependence - modified	alive without severe
7		stroke assessments and	Inclusion criteria:	assessed by the specialist team,	There were clear	Rankin Scale (mRS),	disability at 1 year was also
8		advised ward-based nursing and therapy staff	Patients with disabling stroke who could be supported at home	which undertook a diagnostic	guidelines for acute care, prevention of		significantly higher on SU vs. ST or DC.
9		on acute care, secondary	with nursing, therapy and social	evaluation and assessment for needs. Ward provided the day-	complications,	Secondary outcomes	31 01 DC.
10		prevention and	services input on initial assessment	to-day treatment, the team	rehabilitation and	included	These differences were
11		rehabilitation aspects.	were included in the study.	advised on specialist aspects of	secondary prevention,	Orgogozo scale, BI and FAI	present at 3 &
12		2) DC (n=153)	Exclusion criteria	stroke care. It reviewed progress and treatment of individual	and a culture of joint	for disability, the	6 mths after stroke.
13		Domiciliary care provided	Patients with mild stroke,	patients with ward team &	assessments, goal	mRS for handicap	Starling suppliants of the last
		management at home under the supervision of a	severe strokes, already admitted to hospitals, and those with	helped in discharge planning and setting up of post discharge	setting, coordinated treatment and	EuroQol-guality of	Stroke survivors on SU showed greater improvement on basic
14		GP and stroke specialist	unusual or atypical neurological	services. The team provided	discharge planning.	life of patients and their	activities of daily living
15		with support from	features who required specialised	counselling, education and	albena ge planning.	carers.	compared the other two grps.
16		specialist team and	assessments or investigation to	support to the family, identified expectations and advised about	A coordinated		Achievement of higher levels
17		community services.	establish a diagnosis of stroke.	realistic outcomes in the context	multidisciplinary		of function was not
18		Support was provided for	Patients who were	of previous morbidity and	approach was adopted		influenced by strategy of care.
		a maximum of 3 months. Control:	institutionalised or had severe disability (Rankin 4 or 5) before	present deficits. DC Patients were managed in	towards rehabilitation, with emphasis on early		QoL at 3mths was significantly
19		Usual care SU (n=152)	stroke	own home by a specialist team	mobilisation. All		better in SU & DC patients.
20		The stroke unit provided	Baseline characteristics of	consisting of a doctor (specialist	patients had an		
21		24-hour care provided by	participants SU vs. ST vs.HC	registrar), a nurse (G grade) & therapists (senior I grades), with	individualised		There was greater
22		a specialist	Median age (years) (IQR) 75 (72–	support from district nursing and	rehabilitation plan with		dissatisfaction with care with
23		multidisciplinary team based on clear	84) 77.3 (71–83) 77.7 (67–83) No. of females (%) 69 (46.6) 76	social services for nursing and personal care needs. Patients	clearly defined goals based on joint		ST vs. SU or DC.
24		guidelines for acute care,	(50.6) 68 (45.6) Living alone (%) 50	were under the joint care of the	assessments. Patient		Poor outcomewith DC and ST
25		prevention of	(33.7) 55 (36.6) 50 (33.5)	stroke physician and GP.	participation was		was associated with Barthel
26		complications,		Investigations, including CT scanning, were performed in	encouraged, with focus		Index <5, incontinence and
		rehabilitation and		outpatient s. Therapy was	on motivation and		with ST, age >75 years.
27		secondary prevention.		provided by members of the specialist stroke team. Each	providing an enriched environment.		The total costs of
28		prevention.		patient had an individualised	environment.		stroke per patient over
29				integrated care pathway			12mths were £11,450 for SU,
30				outlining activities and the objectives of treatment, which			£9527 for ST & £6840 for DC
31				was reviewed at weekly			The mean costs per day
32				multi-disciplinary meetings.			alive for the SU were
							significantly less than those for the ST , but no different
33							for the ST, but no different from DC patients.
34							Costs for DC were significantly
35							less than for those managed
36							by the SU or ST.
37							
38							
39							
40							

Pag	je <u>59. p</u> f 70	Study	Participants	Intervention	Control BMJ Ope	n <sub>Outcomes</sub> assessed	Results
	Year						
	Country	<b>-</b>					
1	Rodriguez- Cerrillo	Prospective controlled study	Inclusion criteria: ≥70 years diagnosed with	Outline of intervention	Outline of control Intervention delivered	Relevant measures & outcomes	A small amount of free fluid was present in 38% of patients
2	Cerriio	study	uncomplicated diverticulitis (The	Intervention delivered by;	by:	outcomes	treated with HaH and 42% of
3	2013	Intervention:	existence of abscess, fistula, bowel	All patients were given	All patients were given	No primary nor secondary	patients in hospital.
4		Patients stayed 24 h in the	obstruction and peritonitis)	Ertapenem after diagnosis.	ertapenem after	outcomes were defined	All patients had a good clinical
	Spain	Observation Ward within	Patients who were willing to be	Patients in HaH grp stayed	diagnosis & experienced traditional		evolution. None of the
5	uncomplicate	ED prior to discharge and treatment at home. (n=34)	treated at home and had a caregiver 24 h a day were	24 h in the observation ward within ED prior to	hospitalisation		patients treated with HaH needed be transferred to
6	d	Control:	transferred to HaH. The rest of the	discharge.	noopranoación		hospital.
7	diverticulitis	Traditional hospitalization	patients were admitted to	At home, nurses			Mean stay was 9 days in HaH
8		(n=18)	conventional hospitalization.	administrated Ertapenem			vs. 10 days in Hospital.
9			Exclusion criteria	every day. The physician conducted 2–3 home visits			The cost of each patient with diverticulitis treated at home
10			Patients with complicated	per week, depending on the			was 1368 euros cheaper than
11			diverticulitis, β-lactam allergy or	patient's clinical course. On			the cost of a patient treated in
12			who required admission to	admission patients were			the hospital (fewer staff and
13			hospital for other pathology	provided with a phone number to contact the unit			important reduction of maintenance costs).
14			Baseline characteristics of	if any problem arose.			
15			participants	Intravenous antibiotic was			
			intervention vs. control	changed to oral therapy			
16			Age 77 (71–90) 79 (71–98)	(amoxicillin– clavulanate) after 4–6 days			
17			Sex (female) 28 (82.4%) 16 (84.2%)	of treatment until complete			
18			Cardiopathy 9 (26.5%) 6 (31.6%)	10 days of			
19			Diabetes mellitus 4 (11.7%) 2	treatment.			
20			(10.5%) Chronic renal failure 4 (11.7%) 1				
21			(5.2%)				
22			Neoplasm 1 (2.9%) 1 (5.2%)				
23			COPD 1 (2.9%) 1 (5.2%)				
24			Corticosteroids 4 (11.7%) 2 (10.5%) Previous diverticulitis 7 (20.5%) 3				
25			(15.8%)				
			Abdominal pain 34 (100%) 19				
26			(100%)				
27			Fever 9 (26.5%) 6 (31.6%) Diarrhea 6 (17.6%) 3 (15.8%)				
28			Leucocytosis 7 (20.5%) 3 (15.8%)				
29							
30							
31							
32							
33							
34							
35							
36			<u> </u>	l	l		
30 37							
38							
39							
40							

Author	Study	Participants	Intervention	BMJ Open	Control	Outcomes assessed	Results
Year Country							
Leff	Prospective quasi	Inclusion criteria:	The study was conducted in 3	Outline of intervention	Outline of control	Relevant measures &	Intervention vs. control
Len	experimental	Community-dwelling persons ≥65	Medicare managed care	&who delivered 1 Nov	1 Nov 1990-	outcomes	intervention vs. control
[3066]		yrs old, Lived in catchment area	(Medicare +Choice) plans at 2 sites	2001-30 Sep 2002	30 Sep 2001) Eligible		Mean LoS (SD) days
		In the opinion of a physician not	and at a Veterans	Patients evaluated	patients identified &	No distinction between	4.9 (9.9) 3.2 (2.5) p =0.004
	2 consecutive 11 month	involved in study, required	Administration medical centre.	by HaH physician either in	followed through usual	primary and secondary	
2005	phases	admission to an acute care	Univera Health and Independent	ED or after ambulance	hospital care.	outcomes	Mean time in ED (SD) in hrs
		hospital for these illnesses:	Health, in Buffalo, New York, are	transfer to home. HaH		Intervention group	6.4(1.8,11.6)SD 1.9 vs.
USA	Intervention:	community-acquired pneumonia,	Medicare + Choice plans These 2	nurse met ambulance		comprised all patients	5.5(1.0,21.3) SD3.2
Plus	Treatment in a hospital-at-	exacerbation of chronic heart	plans collaborated to provide	at patient's home and		eligible for hospital-at-home	P=0.001
Leff 2009	home model of care that substitutes for	failure or chronic obstructive pulmonary disease, or cellulitis.	hospital- at-home care and made up 1 study site (site 1).	provided direct one-on- one nursing for an initial		care, irrespective of where they were treated.	[Leff 2005]
[2545]	treatment in an acute care	Required to meet validated criteria	up I study site (site I).	period of $\leq$ 8hrs at site 3		[thus some outcomes are	Changes in ADL and IADL from
Frick 2009	hospital. Offered In the 2 <sup>nd</sup>	of medical eligibility for hospital-	The Fallon Health Care System (site	and ≤24 hrs at sites 1 &		NOT useful to us but some	1mth before admission -2
[0158]	phase of study	at-home care.	2), in Worcester, Massachusetts,	2. followed by		measures are HaH specific]	weeks after intervention
	n=169	Exclusion criteria	operates a not-for-profit Medicare	intermittent nursing visits			ADL 0.39(3.13) vs0.6(3.09)
		Most common reasons for medical	+Choice plan, and the Fallon Clinic,	and HaH physician at		Mean LoS (SD) days [Leff	p=0.1
	Control:	ineligibility were uncorrectable	a for-profit multispecialty physician	least daily. HaH physician		2005]	IADL 0.74(2.86) vs0.70(2.68)
	Described as 'observation	hypoxemia, suspected myocardial	group, provides care on a capitated	was available 24 hours a			p=0.007
	group' in the first phase of	ischemia, and presence of an acute	basis to Medicare + Choice	day for visits. Nursing and		Mean time in ED (SD) in hrs	[Leff 2009]
	study. Eligible patients	illness, other than the target	beneficiaries.	other care components,			Costs
	were identified and followed through usual	illness, for which the patient was required to be hospitalized.	The Portland, Oregon, Veterans	e.g. durable medical		Sub-analysis of HaH vs. Non-	Within each health system
	hospital care.	Baseline characteristics of	Administration Medical Center (site	equipment, oxygen therapy were provided		HaH (i.e. different to main	and per condition Mean (SD)
	n=286	participants at all sites	3) is a quaternary care and teaching	and some services e.g.		report [Leff 2009]	Overall
		(Stats shown if signif)	facility.	home radiology, support		Changes in ADL and IADL	\$5081(4427)vs.\$7480(8113) p<0.001
	Aim:	Observation vs. intervention Age		provided by independent		from 1mth before	Pneumonia
	'to evaluate the safety,	(SD) 77.3 (6.6) vs.77.2(7.0)	A patient requiring admission to the	contractors. Lifeline		admission -2 weeks after	\$5272(6036) vs. \$6761(6451)
	efficacy, clinical and	% female 34 vs. 42%	acute care hospital for a target	devices were provided for		intervention	NS
	functional outcomes,	% white 90 vs.86%	illness was identified in an ED or	patients living alone.			Congestive heart failure
	patient and caregiver	% in poverty 11 vs.19%	ambulatory site and his or her	Diagnostic tests,		Costs	\$3310(2118) vs. \$6399(6643)
	satisfaction, and costs of	p=0.027	eligibility status was determined.	IV fluids, IV antimicrobial		Within each health system	p≤0.001
	providing acute hospital level care in a hospital at	% live alone 43 vs.33% p=0.022	Non-study medical personnel, usually ED physicians, made the	agents, etc. and oxygen/respiratory		and per condition [Frick 2009]	COPD
	home that substituted	Mean mini mental state (SD)25.5	decision to hospitalize the patient.	therapies were provided		2009]	\$4293(3806) vs. \$6500(7305)
	entirely for admission to	(4.2) vs. 25.2(4.4)	All patients who were offered but	at home.		Overall summary	<b>p≤0.05</b> Cellulitis
	an acute care hospital for	Mean Charlson score (SD)	who declined hospital-at-home	Patient was followed by		'The HaH care model is	\$4262(2309) vs. \$7287(11471)
	older persons.'	3.1 (2.0) vs.3.0 (1.8)	care were admitted to the acute	same physician until		feasible, safe, and	NS
	Setting:	Mean medications (SD) 6.8 (3.9)	care hospital.	discharged		efficacious for certain older	[Frick 2009]
	Intervention (if received):	vs. 8.1(4.5) p=0.002	Study coordinators verified the	to primary care		patients with selected acute	
	At home	%Primary admission diagnosis	patient's eligibility for HaH using a			medical illnesses who	
	Control	Pneumonia 31vs. 32%	standard protocol at enrolment.			require acute hospital-level	
	Secondary hospital care	COPD 32 vs.28%	Most patients were identified the			care.' Leff 2005	
	Power calculation:	Cellulitis 12 vs 18% CHF 25vs.22%	morning after admission.			HaH care is associated with modestly better	
	No					improvements in IADL	
						status and trends toward	
						more improvement in ADL	
						status than traditional acute	
						hospital care. Leff 2009	
						Total costs seem to be	
						lower when substitutive	
						HaH care is available for	
						patients with CHF or COPD	
		1		1		disease.Frick2009	

#### Page 61 of 70 Hospital in Nursing/Care Home (HNCH) (n=2)

 **BMJ Open** 

Author	Study	Participants	Intervention	Control	Outcomes assessed	Results
Year						
Country						
Crilly	'quasi experimental'	Inclusion criteria:	In the ED. Enrolments were made	Outline of control	Relevant measures &	HINH vs. Control
2010		Reside in an ACF.	by HINH programme manager	The comparison group	outcomes	
Australia	[Controlled (his) study]	Have a signed GP request for HINH	(registered nurse) with programme	was selected from		Mean (SD)
		review from the ACF.	director (ED director), GPs and ACF	patients who presented	Hospital LOS (days)	Hospital LOS
		Be of any age (usually≥ 65 yrs).	nursing staff, as appropriate. After	to ED and were		2.19 (0.82) vs.6.2(0.59) da
	Intervention:	Present with an illness that	hours and on weekends, if	subsequently admitted	ED LOS (hours)	p<0.001
	Hospital in the nursing	required hospital services but not	patient was suitable for HINH , they	during the same time		
	home (HINH) n=62	necessarily admission e.g. UTI &	stayed in ED short stay unit and	period. To be included in	Episode of care (total time)	ED LOS
		could have treatment e.g.	were reviewed by HINH nurse on	this group, the patients	LOS (days)	9.94(0.66) vs. 7.01(0.47) h
	Control:	antibiotics continued by ACF staff.	next weekday.	had to reside in an ACF	Laws (Column) up about	p=0.005
	Usual in-hospital care	Prior to start of HINH, patients	Outline of intervention	and be aged ≥65yrs. ACF	Long (≥6days) vs. short	Eninodo of Caro LOC
	n=115	who would have fit inclusion	Outline of intervention The HINH nurse checks with the	residents who presented to the ED were in some	hospital LOS	Episode of Care LOS
		criteria for hospital admission				9.56(1.26)vs. 6.20(0.59) da
		Exclusion criteria: ACF residents who required	ACF registered nurse and patient on	cases not enrolled in HINH because they	Long (≥8 days) ED LOS vs. short	p=0.14
		extensive treatment that could not	the patients' progress initially on a daily basis and then every couple of	had a medical problem	snort	Percentages
		be managed in ACF or who	days. Discharge occurs when	that was judged as	Long episode of care (≥6	Hospital LOS 6+days
		required specific services that	required treatment has ceased. This	possibly requiring in-	days)	9.6 vs. 40 p<0.001
		could only be received in hospital	completes the patients' hospital-	hospital admission	uuysj	Episode of care 6+days
		e.g. surgery	affiliated episode.	services beyond those	Hospital readmissions	46.8 vs.40.0 p=0.35
		c.g. surgery	armateu episoue.	offered by the	within 28 days	LOS in ED 8+ hours
		Baseline characteristics of		HINH.	within 20 days	50.0vs.33.9 p=0.05
		participants	Intervention delivered by:			50.003.55.5 p=0.05
		HINH vs. Control	HINH programme delivers acute	Intervention delivered	Costs	Readmission in 28 days
		Age (SD) 85(7.1) vs.84.6(6.6)years	care nursing support services,	by:	None	11.3 vs. 11.3 p=0.99
		Triage category	medication and equipment to the	No details but	None	11.5 V3. 11.5 p=0.55
		3.2 (0.7) vs.3.2(0.7)	ACF registered nurse and/or	presumably usual		
		Female 76vs. 75%	enrolled nurse. These services may	hospital staff		
		Diagnostic category: Respiratory	include	nospital stall		
		24 vs.26%	initial training and education			
		Cellulitis 18 vs.17%	regarding antibiotic or IV fluid			
		Kidney/urinary tract 18vs.16%	administration; specific wound			
		Cardiac 10 vs. 10 %	treatment and dressing procedure			
		Abdominal/GI 8vs.8%	(with dressing materials);		4	
		Viral/sepsis 7 vs.6%	suprapubic catheter care,			
		All other 16 vs.17%	behaviour management and			
			palliative care.			

Author	Study	Participants	Intervention	com J Open	Outcomes assessed	Results
Year Country						
Lau	Controlled (his) Case	Inclusion criteria:	In the ED the acuity of presenting	Outline of control	Relevant measures &	TRC vs. ACU
	series	Patient and/or family consent	complaint was triaged to maximize	Aged care unit (ACU)	outcomes	Palliative care
2013		Capacity within HITH to accept the	service capacity. Overnight referrals			34 (35.8%) 13 (7.8%) <0.001
	Intervention Treatment	patient	were assessed next morning, (those	Inpatients treated in ACU	Palliative care	Mortality on discharge
Australia	in residential care	Facility able to manage the care	who presented after hours were	in preceding year July-		11 (11.6%) 20 (12.0%)
	facilities (TRC) grp	needs of the patient in the	put in Short Stay Unit adjacent to	October 2007, before	Mortality on discharge	p=0.924
	n=95	residential aged care facility	ED for assessment. TRC generally	existence of TRC.		6-month mortality
		(RACF)	provided once daily visits for	ACU is a service for	6-month mortality	29 (30.5%) 51 (30.5%)
	Control		patient.	inpatients who have been		p=0.184
	Hospital-based aged	Exclusion criteria:	The geriatrician & team members	admitted from residential	Rehospitalisation within 1-	Re-hospitalization within 1
	care unit (ACU) n=167	Lack of consent from patient	would use clinical judgement to	care facilities for the	month	month
		and/or family.	determine if a patient was suitable	management of general		20 (21.1%) 35 (21.0%) p=0.
		Behavioural disturbances, which	for TRC	medical conditions.	Total hospitalisation at 6	Total re-hospitalization at
		may prevent the delivery of care			months	months
		e.g. aggressive behaviour and	Outline of intervention	Intervention delivered		39 (41.1%) 68 (40.7%) p=0.9
		frequent removal of IV, access	Treatment in Residential Care	by:	Length of hospital care/stay	Length of stay
		device.	facilities (TRC) delivered by the	No details but		Mean ( no SD given ) 2vs.1
		History of recent falls, which may	Residential Care Intervention	presumably usual	All measured as 'present or	days
		impact on the delivery of care in	Program into the Elderly (RECIPE)	hospital staff	not'	P<0.001
		the RACF.	service between July-Oct 2008.			Equivalent of 270 vs. 1840
		If there was conflict regarding				bed days
		management, further input and	Appropriate Clinical Diagnosis		Costs	
		discussion were carried out in	Dehydration, Pneumonia, Urinary		None	
		ACU.	Tract Infection, Gastroenteritis,			
			Deep Venous Thrombosis, Terminal			
		Baseline characteristics of	care support.			
		participants				
			Treatment can therefore include			
		TRC vs. ACU	any of the following:			
		Age 83.5 vs.82.8yrs	IV antibiotics & IV fluids			
		Female 53 vs.59%	Anticoagulation			
		Non-English speaking	Oxygen therapy (low flow)			
		42 vs.48%	Appropriate Allied Health			
		High level of nursing homecare	intervention			
		72 vs.76%	Palliative support*			
		Dementia 77.9vs.45.5% p<0.001	Referral to other appropriate			
		Charlson score 7.1 SD 1.9 vs. 7.2 SD 2.3	support programs			
		7.1 SD 1.9 VS. 7.2 SD 2.3	* [TDC also offered pollistive care			
			* [TRC also offered palliative care			
			as appropriate. If patient's			
			condition changed and management could not be			
			continued, transfer into		4	
			acute hospital was organized. If			
			patients had uncertain prognosis,			
			treatment was given, followed by			
			palliative care if no response		24,0	
			despite optimal treatment.]			
			acopite optimiti treatmentij			
			Intervention delivered by:			
			Geriatrician, registrar and nursing			
			staff with access to allied health			
			staff such as physiotherapy, OT,			
			speech pathology and social work.			

### Appendix 6: Characteristics of those older patients for whom the decision to admit to hospital may be unclear

Patient characteristics	Studies which include such populations
Age ≥75 years	15/19 studies
for included patients	Mason 2007 & 2012; Benaiges 2014; Salvi 2008; Garasen 2007; Vincente 2014; Patel 2008; Mendoza 2009; Tibaldi 2009; Ricauda 2008; Kalra 2005; Rodriguez-Cerillo 2013 Leff 2005; Crilly 2010; Lau 2013
Co/multi-morbidities	9/19 studies
in included patients stated either by number of conditions or multi-morbidity score e.g. Charlson Score	Benaiges 2014; Salvi 2008; Patel 2008; Mendoza 2009; Tibaldi 2009; Ricauda 2008; Carratala 2005; Leff 2005; Lau 2013
Dementia	a) 2/19 studies
either stated in a) patient demographics or b) used as an exclusion criterion based on severity	Rodriguez-Cerillo 2009; Lau 2013
	b) 8/19 studies
	Mason 2007; Sun 2014; Salvi 2008; Garasen 2007; Mendoza 2009; Tibaldi 2009; Ricauda 2008; Lau 2013
Social care support	3/19 studies
stated in inclusion/exclusion criteria	Tibaldi 2009; Ricauda 2008; Kalra 2005;
Home situation	7/19 studies
stated in inclusion/exclusion criteria	Benaiges 2014; Garasen 2007; Mendoza 2009; Ricauda 2008; Rodriguez-Cerillo 2009, 2013; Lau 2013
Individual coping abilities	2/19 studies
stated in inclusion/exclusion criteria	Patel 2008; Rodriguez-Cerillo 2013



### **PROSPERO International prospective register of systematic reviews**

## A systematic review to identify and assess the effectiveness of hospital alternatives for people over the age of 65 who are at risk of potentially avoidable hospital admission

Alyson Huntley, Melanie Chalder, Will Hollingworth, Chris Metcalfe, Ben Davies, Sarah Purdy

### Citation

Alyson Huntley, Melanie Chalder, Will Hollingworth, Chris Metcalfe, Ben Davies, Sarah Purdy. A systematic review to identify and assess the effectiveness of hospital alternatives for people over the age of 65 who are at risk of potentially avoidable hospital admission. PROSPERO 2015:CRD42015020371 Available from http://www.crd.york.ac.uk/PROSPERO\_REBRANDING/display\_record.asp?ID=CRD42015020371

### **Review question(s)**

1) What admission alternatives are there for older patients and do they improve patient outcomes e.g. mortality, quality of life?

2) What are the defining characteristics of those older patients for whom the decision to admit to hospital may be unclear?

### Searches

MEDLINE, MEDLINE in process, EMBASE, CINAHL and the Cochrane Central Register of Controlled Trials (CENTRAL) from 2005 to April 24th 2015. The Kings Fund and AHRQ websites were also searched

### Types of study to be included

Any type of controlled study

### Condition or domain being studied

Any condition that may result in an avoidable hospital admission in patients over the age of 65.

### **Participants/ population**

People over 65 years of age of either sex living in OECD countries who are at risk of an unplanned admission (probably for an ambulatory sensitive condition) - they will therefore not be admitted to hospital at time of recruitment but could be in community or emergency department (being assessed).

### Intervention(s), exposure(s)

The intervention of interest is admission to hospital, using definitions developed for previous studies (Huntley et al, Family Practice Fam Pract. 2013 Jun;30(3):266-75.). However it is important to point out that admission is likely to be the control group in many relevant studies.

### Comparator(s)/ control

Alternatives to admission (likely to be described as the intervention) including but not limited to: hospital at home, virtual ward, rapid response nursing, care at home, admission to a care home, usual care.

### Context

Reducing emergency bed days is one of the biggest challenges currently facing the National Health Service (NHS). There is considerable pressure to reduce hospital admissions amongst older people (D'Souza, BMJ 2013). There has been a 65% increase in hospital admissions for those over 75 years of age in the last decade ,and the oldest old, those over 85 years , now account for 11% of emergency admissions and 25% of bed days (NHS England 2013). There are some older people for whom care in the community is safe,perhaps with the provision of additional services and some for whom admission is required in order to deliver diagnostic or treatment techniques that are only available as an in patient. This review seeks to identify interventions for those patients that do not fall neatly into one of these categories and in doing so will assess the efficacy of the interventions and provide more detail on this patient

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population.

### **Outcome(s)**

**Primary outcomes** 

1) Patient outcomes (including mortality, quality of life, length of stay, readmission, adverse effects of intervention) plus costs if available.

2) Patient characteristics for whom their pathway (admission or not) is unclear including risk factors e.g. comorbidities (mental & physical), age, gender, social circumstances ,disease severity, recent admission/discharge availability of other services

Secondary outcomes

None

### Data extraction, (selection and coding)

Standardised data extraction forms will be developed using existing guidelines (Higgins 2008 Cochrane handbook chapter 7 section 7.5). Data will be abstracted by one reviewer. A second reviewer will check data abstraction against the original paper. Data items: details on participants, Interventions, comparisons, outcome measures

### Risk of bias (quality) assessment

Cochrane risk of bias tool will be used for randomised controlled trials. CASP criteria will be used for controlled trials

### Strategy for data synthesis

Meta-analysis of data will be performed using Review Manager Version 5.1 if there are at least three trials with combinable data with a fixed or random effects model depending on the level of between trial heterogeneity estimated using the I-squared statistic. Sensitivity analysis will be performed as the data dictates.

### Analysis of subgroups or subsets

Dependent on data found

### **Dissemination plans**

This review is part of programme development grant.

### **Contact details for further information**

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### **Review team**

Dr Alyson Huntley, University of Bristol



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Page 66 of 70 National Institute for Health Research

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### Collaborators

Dr Ali Heawood, University of Bristol Mrs Helen England, BrisDoc Professor Jonathan Benger, University of the West of England

### Details of any existing review of the same topic by the same authors

None

Anticipated or actual start date 02 February 2015

### Anticipated completion date

29 January 2016

**Funding sources/sponsors** NIHR Programme Development Grant RP-DG-1213-10004

### **Conflicts of interest**

None known

### Language

English

### Country

England

### Subject index terms status

Subject indexing assigned by CRD

### Subject index terms

Hospitalization; Hospitals; Humans

### Stage of review

Ongoing

### **Date of registration in PROSPERO** 14 May 2015

### Date of publication of this revision

14 May 2015

### DOI

10.15124/CRD42015020371

Stage of review at time of this submission	Started	Completed
Preliminary searches	No	Yes
Piloting of the study selection process	No	Yes
Formal screening of search results against eligibility criteria	Yes	No

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National Institute for Health Research

Data extraction	No	No
Risk of bias (quality) assessment	No	No
Data analysis	No	No

### **PROSPERO**

The information in this record has been provided by the named contact for this review. CRD has accepted this information in good faith and registered the review in PROSPERO. CRD bears no responsibility or liability for the content of this registration record,

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### PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Page 1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	Pages 2-3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	Page 5
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	Pages 5-6
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	Page 6
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	Page 6
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	Page 6
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Appendix 1
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	Pages 6-7
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	Page 7
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	Page 7
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	Page 7
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	N/A
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., $I^2$ ) for each meta-analysis.	Page 8



### **PRISMA 2009 Checklist**

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	Page 7
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	n/a
2 RESULTS			
3 Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	Page 8 and Figure 1
6 Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Pages 8-17
8 9 9 0	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	Pages 8-17 and Appendices 2 & 3
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Pages 8-17 and Appendix 5
3 Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	Pages 8-17 plus narrative presentation
6 Risk of bias across 7 studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	Pages 8-17
8 Additional analysis 9	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	n/a
DISCUSSION			
2 Summary of evidence 3	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	Page 18
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	Pages 18-19
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	Page 19
1 Funding 2	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	Page 21

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*From:* Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. 45 doi:10.1371/journal.pmed1000097

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## **BMJ Open**

### A systematic review to identify and assess the effectiveness of alternatives for people over the age of 65 who are at risk of potentially avoidable hospital admission.

Journal:	BMJ Open
Manuscript ID	bmjopen-2017-016236.R2
Article Type:	Research
Date Submitted by the Author:	31-May-2017
Complete List of Authors:	Huntley, Alyson; University of Bristol , School of Social & Community Medicine Chalder, Melanie; University of Bristol, School of Social & Community Medicine Shaw, Ali; University of Bristol, School of Social & Community Medicine Hollingworth, William; University of Bristol, School of Social & Community Medicine Metcalfe, Chris; University of Bristol, Bristol Randomised Trials Collaboration; University of Bristol , School of Social & Community medicine Benger, Jonathan; The University Hospitals NHS Foundation trust, Academic Department of Emergency care; The University of the West of England, Faculty of Health & Life Sciences Purdy, Sarah; University of Bristol, School of Social & Community Medicine
<b>Primary Subject Heading</b> :	Emergency medicine
Secondary Subject Heading:	Geriatric medicine
Keywords:	GERIATRIC MEDICINE, Organisation of health services < HEALTH SERVICES ADMINISTRATION & MANAGEMENT, ACCIDENT & EMERGENCY MEDICINE

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people over the age of 65 who are at risk of potentially avoidable hospital admission.

Alyson L Huntley\* Melanie Chalder<sup>1,2</sup> Alison Shaw<sup>1</sup> Will Hollingworth<sup>3</sup> Chris Metcalfe<sup>1,4</sup> Jonathan Benger <sup>5,6</sup> Sarah Purdy<sup>1</sup>

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### Word count 4335

**Key words:** Systematic review, emergency medical services, aged, hospitalization, hospital alternative

#### 31.05.17

### ABSTRACT

### **Background / objectives**

There are some older patients who are 'at the decision margin' of admission. This systematic review sought to explore this issue with the following objective: What admission alternatives are there for older patients and are they safe, effective and cost-effective? A secondary objective was to identify the characteristics of those older patients for whom the decision to admit to hospital may be unclear.

### Design

Systematic review of controlled studies (April 2005-December 2016) with searches in Medline, Embase, Cinahl and CENTRAL databases. The protocol is registered at PROSPERO (CRD42015020371). Studies were assessed using Cochrane risk of bias criteria, and relevant reviews were assessed with the AMSTAR tool. The results are presented narratively and discussed.

### Setting

Primary and secondary health care interface.

### **Participants**

People aged over 65 years at risk of an unplanned admission.

### Interventions

Any community-based intervention offered as an alternative to admission to an acute

hospital

### Primary and secondary outcomes measures

Reduction in secondary care use, patient-related outcomes, safety and costs.

### Results

Nineteen studies and seven systematic reviews were identified. These recruited patients with both specific conditions and mixed chronic and acute conditions. The

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interventions involved paramedic/emergency care practitioners (n=3), emergency department-based interventions (n=3), community hospitals (n=2), and hospital-at-home services (n=11). Data suggest that alternatives to admission appear safe with potential to reduce secondary care use and length of time receiving care. There is a lack of patient-related outcomes and cost data. The important features of older patients for whom the decision to admit is uncertain are: age over 75 years, co/multi-morbidities, dementia, home situation, social support and individual coping abilities.

#### Conclusions

This systematic review describes and assesses evidence on alternatives to acute care for older patients and shows that many of the options available are safe and appear to reduce resource use. However, cost analyses and patient preference data are lacking.

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### STRENGTHS AND LIMITATIONS OF THIS REVIEW

<text>

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#### Introduction

Reducing emergency bed days is one of the biggest challenges currently facing the National Health Service (NHS) in the United Kingdom (UK) and there is considerable pressure to reduce hospital admissions amongst older people throughout the developed world.<sup>1</sup> It has been suggested that clinicians should: 'choose to admit only those frail older people who have evidence of underlying life-threatening illness or need for surgery'.<sup>2</sup> In the UK there has been a 65% increase in hospital admissions for those over 75 years of age in the last decade. Furthermore, people over 85 years of age now account for 11% of emergency admissions and 25% of critical care bed days.<sup>3</sup> The international literature indicates that decisions to admit to an acute hospital are often influenced by inadequate knowledge of the patient or condition, communication difficulties between primary and secondary care, presence of co-morbidities, availability of test results, perceived benefits of in-patient care and patient preferences.<sup>4</sup> A review by NHS England highlighted the need to identify those frail and elderly people who need care but do not have a medical need requiring hospital admission.<sup>3</sup> It is clear that there are some older patients for whom care in the community is safe, perhaps with provision of additional services, and some for whom admission is required to deliver diagnostics or treatment that are only available in hospital. However, for those patients 'at the decision margin', the best path of action may be unclear.<sup>5</sup> The decision may be affected by non-clinical and clinical factors e.g. multi-morbidity, how much risk the patient or family are willing to accept.

Our specific objective was to conduct a systematic review to identify studies of community-based interventions aimed at reducing secondary care use in older patients with acute medical problems potentially requiring unscheduled hospital

admission. A secondary objective was to further confirm the characteristics of those older patients for whom the decision to admit to hospital may be unclear.

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#### Methods

#### Protocol and registration

The protocol for the systematic review was registered at the PROSPERO register on 14/06/2015. Registration number is: CRD42015020371 (Supplementary material)

#### Eligibility criteria

Publications of any randomised or non-randomised controlled trial (RCT or nRCT) which fitted our PICO criteria: a **P**opulation aged over 65 years, of either sex living in Organisation for Economic Co-operation and Development countries being considered for an unplanned admission, receiving either an Intervention considered to be an alternative to acute hospital admission or acute hospital admission (**C**ontrol). The studies needed to record at least one of the following as either a primary or secondary **O**utcome: intervention effectiveness in terms of patient's subsequent ED attendance or readmission, patient-related outcomes, safety or healthcare costs.

#### Information sources and searches

Medline, Medline In-Process, Embase, Cinahl and CENTRAL databases were searched from January 2005-April 2015 inclusive using search terms based on the eligibility criteria. (Appendix 1) An update was run in December 2016 across Medline and Medline In-Process. We included any relevant systematic reviews published 2010- 2016. The decision to time limit the searches was based on the fact that the systematic reviews would cover any older studies and that any evidence not included in these two sources was unlikely to be relevant to the fast changing

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primary and secondary health care interface. The King's Fund and Agency for Healthcare Research and Quality websites were also searched in April 2015.<sup>6,7</sup> References were managed using EndNote X6 software and were screened by title and abstract followed by full text, both independently and in duplicate (AH, BD), using predefined inclusion/exclusion criteria. Any disagreements in either stage were resolved using a third reviewer (SP). The reference lists of included studies were checked and forward referencing was conducted using Google Scholar. Authors of included studies were contacted for details of any extra studies.

#### Data items and collection process

Data from all primary studies (2005-2016) were extracted into a custom-designed table. The main results and conclusions of recent high quality systematic reviews (2010-2016) which included relevant primary studies were also recorded.

#### Assessment of risk of bias of individual studies (Appendix 2)

The Effective Practice and Organisation of Care Cochrane risk of bias tool was used to critically appraise RCTs and nRCTs.<sup>8</sup>

#### Assessment of methodological quality of systematic reviews (AMSTAR)

#### (Appendix 3)

The AMSTAR checklist was used to assess the quality of the included systematic reviews.<sup>9</sup>

#### Synthesis of results

The data are presented narratively describing, if present, the most relevant systematic review and/or individual studies for each intervention and, where appropriate, for a specific condition.

In order to identify the characteristics of those older patients for whom the decision to admit to hospital may be unclear, the inclusion/exclusion criteria and demographics of the participants were examined and key features were tabulated alongside the number and references of relevant studies.

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Summary Table: RCT/nRCT and systematic evidence for alternative to admissions for the older population

Intervention/ setting	Paramedic/ emergency care practitioner	Emergency department	Community hospital	Hospital at home Heart Failure	Hospital at home COPD	Hospital at home Pulmonary embolism	Hospital at home Pneumonia	Hospital at home Stroke	Hospital at home Uncomplicated diverticulitis	Hospital at home Older population with acute medical problems
Primary studies identified 19 studies over 24 papers n=10 RCT, n=9 nRCT	n=3 (RCT & 2 nRCT) Mason 2007 Gray 2008 Mason 2012	n=3 (RCT & 2 nRCT) Sun 2014 Benaiges 2014 Salvi 2008	n=2 RCT Vicente 2014 Garåsen 2007, 2008ab	n=3 RCT Mendoza 2009/García- Soleto 2013 Tibaldi 2009 Patel 2008	n=1 RCT Ricauda 2008	n=1 nRCT Rodriguez-Cerillo 2009	n=1 RCT Carratala 2005	n=1 RCT (3 arm) Kalra 2005	n=1 nRCT Rodriguez-Cerrillo 2013	n=3 nRCT Leff 2005/2009/Frick 2009 Crilly 2011 Lau 2013
Main conclusions of primary studies Statistically significant differences between alternative care and acute hospital care	Mason RCT Reduction: Risk of ED attendance, Risk of hospital readmission. Increase: Satisfaction with care Mean duration of care Subsequent unplanned contacts with secondary care Comparable: Mortality Two nRCTs report greater reduction in admissions No cost data	Sun RCT Reduction: Time of episode of Care Less likely to be admitted into hospital Costs Comparable: Serious events QoL Satisfaction with care ************************************	Vincente Data limited. Neither formal analyses nor cost data presented. Garåsen Reduction: Hospital readmissions Receiving any care at 26 wks Deaths Total costs & mean costs per patient Increase: Observation period	Meta-analysis in systematic review	Reduction: Readmissions Mean cost per patient Increase: Length of stay. Comparable: Depression QoL Mortality	Comparable: Mean length of stay No major bleeding, thrombosis or death in either group No cost data	Increase: Patients were satisfied with care Comparable: An overall 'successful outcome' Readmissions QoL Adverse drug reactions Medical complications Mortality No cost data	Increase: Mortality & institutionalisation Reduction: QoL scores basic activities of daily living Costs were lower for HaH group but eclipsed by poorer patient outcomes.	Limited data. Reduction: Cost reduction of €1368 per patient. Comparable: Mean length of stay	Leff Reduction: Length of stay Mean treatment cost Comparable: Use of health services ED visits or readmission Crilly Increase: Longer time in ED Comparable: Length of episode of total care No mortality or cost data Reduction: Length of stay Comparable: Mortality Readmissions No cost data
Systematic review identified	NO	NO	NO	Quaddoura 2015	Jeppesen 2012	Vinson 2012	Chalmers 2011	Shepperd 2016 Chalmers 2011	Varney 2014	NO
Description of, and main conclusions of systematic review				3 RCTs as above used in meta- analysis Increase: Time to first readmission HQoL at 6 &12 mths Reduction: Costs for index treatment Comparable: Rate of readmission All-cause mortality	8 RCTs 7 did not fit inclusion criteria plus RCT detailed above. <b>Review summary:</b> Selected COPD patients can be safely & successfully treated at home. Favourable readmission rates. A trend towards reduced mortality rate	7 observation studies plus one nRCT detailed above. <b>Review summary:</b> Data are limited, but evidence supports the feasibility & safety of for carefully selected low risk patients.	S studies comprising variety of designs plus one RCT detailed above <b>Review summary:</b> Interventions appear safe. Comparable for mortality, hospital readmissions patient satisfaction. Insufficient data for quality of life or return to usual activities.	Two previous systematic reviews on a mixture of conditions including one RCT described above	Integrative review on admission-avoidance HaH services and included one nRCT described above	

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#### Results

The systematic review identified four types of intervention from across 19 studies published in 24 papers: paramedic/emergency care practitioners (n=3), emergency department (ED) interventions (n=3), community hospitals (n=2), hospital-at-home services (n=11).<sup>10-33</sup> (PRISMA diagram) (Appendix 4) Ten of the included studies were RCTs and nine were nRCTs. (Summary table) Fifteen studies were conducted in western European countries of which four were in the UK. Two studies were conducted in Australia and two studies in the United States (US). Risk of bias, general intervention description, AMSTAR and study data are detailed in the appendices. (Appendix 1) (Appendix 2)(Appendix 3) (Appendix 4)(Appendix 5) There was an obvious divide between risk of bias of RCTs and nRCTs with the RCTs generally at low risk for most domains although for some domains there was insufficient information to be make a judgement (Appendix 2). The nRCTs were at high risk from not being randomised and in some studies there was a suggestion of health professional choice in allocation and as, with the RCTs, information was sometimes lacking. Risk of bias of individual studies is detailed below in the relevant section.

The AMSTAR ratings of the systematic reviews was generally good although some reviews did not list details of excluded studies, included studies of high risk of bias and did not perform publication bias analysis. (Appendix 3)

## Paramedic practitioner/emergency care practitioner (PP/ECP) interventions (Appendix 4)

Three studies were identified <sup>10-12</sup> and no relevant recent systematic reviews.

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A cluster RCT (Mason 2007), compared PPs with additional training (n=1469) with standard PPs (n=1549) in assessing and treating elderly people following 999 calls with the aim of measuring subsequent emergency care.<sup>10</sup> Similarly, two more recent nRCT investigated the role of ECPs in avoiding ED) attendance/admissions in elderly populations.<sup>11, 12</sup> Gray 2008 was a case-series study of ECP attendances for elderly patients aged over 65 years with a fall (n=233) compared with historical controls (n=772), and Mason 2012 was a cluster controlled study of enhanced ECP care for five care homes (n=256) compared with standard care in five other care homes (n=201). Risk of bias was low for all the domains of the cluster RCT and both of the nRCT were at high risk due to lack of randomisation.

In the cluster RCT, all primary outcomes comparing the intervention with the control group were improved: relative risk of ED attendance within 28 days (RR 0.72 (0.68, 0.75)), relative risk of hospital admission within 28 days (RR 0.87 (0.81, 0.94)), being very satisfied with care (RR 1.16 (1.09, 1.23)) and mean total episode duration in hours (-42.2 (-59.5,-25.0)) with a reported p<0.001 for all.<sup>10</sup> The secondary outcome of mortality was comparable between groups, but intervention patients had a greater number of subsequent unplanned contacts with secondary care at 28 days (330 vs. 259 p<0.01).

The two nRCTs reported a greater reduction in admissions when comparing the intervention with normal ECP practice but these results are of limited use due to the high risk of bias of the studies.<sup>11, 12</sup>

None of the studies of PP/ECP interventions provided details of cost data or costeffectiveness analysis.

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#### Emergency department (ED) interventions (Appendix 4)

The searches identified one RCT (Sun 2014) which was assessed to be at low risk of bias, and two nRCT (Benaiges 2014, Salvi 2008) in which the risk of bias was high for several domains including randomisation.<sup>13-15</sup> No relevant, recent systematic reviews were identified.

Sun and colleagues conducted a RCT in which patients attending ED with syncope were randomised to receive either a syncope protocol in an observation unit (n=62) or usual care (n=62).<sup>13</sup> where the maximum stay in the observation unit could not exceed than 24 hours.

In terms of primary outcomes, patients randomised to the intervention spent less time in hospital at the index visit (29 vs. 47 hours p<0.001) and were less likely to be admitted to hospital (RR 0.16 (95% CI 0.09, 0.29) p<0.001). There were no differences in the secondary outcomes of serious events, quality of life (QoL) or satisfaction with care between groups. A reduction in costs was reported but no formal statistical comparison was performed (index visit US\$1400 vs. 2420, 30 days US\$1800 vs.2520 (2011 data)).

The first of the two nRCT compared usual care with treatment in a 'day hospital' for hyperglycaemic crisis from which the main result was improved readmission rates and associated costs (Benaiges 2014), whilst the second nRCT compared a specialist geriatric ED intervention with a standard ED procedure (Salvi 2008) but without evidence of any differences in outcome and had significant differences in baseline demographic data. <sup>14,15</sup>

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## **Community hospital (CH) interventions** (Appendix 4)

Two RCTs were identified describing a community hospital (CH) intervention as an alternative to acute hospital (AH) care<sup>16-19</sup> and no relevant, recent systematic reviews.

Both RCTs were at low risk of bias overall. In the RCT by Vicente, participants were randomised following triage at home to either go to a CH (n=410) or to the ED (n=396).<sup>16</sup> The data presented were limited. The authors reported that the nurse attending the patient at home sent 90 intervention participants to the CH (primary outcome) although six of those individuals were subsequently transferred from the CH to the ED (secondary outcome). There were no formal statistical analyses nor were cost data presented.

The Garåsen RCT compared CH care (n=72) to AH care (n=72) and was published over three separate papers. <sup>17-19</sup> There was no distinction between primary and secondary outcomes. At 26 weeks, there were fewer readmissions in the CH group versus the AH group (19% vs. 36%, p=0.02) and more people receiving no care (25% vs. 10%, p=0.01). At 12 months, there were fewer deaths in the CH group (18% vs. 31%, p=0.03) although the observation period was considerably longer in the CH group (335.7 vs. 292.8 days, p=0.01). Total cost of treatment was less in the CH group compared with those receiving AH care NOK 39,650 ((95% CI kr 30 996-48,304) versus NOK 73,417 (95% CI NOK 52 992-93,843)) data collected 2003-2005 (p = 0.002). Average health services costs per patient/day for the entire observation period was NOK 606 (95% CI £ 450- 761) in the CH group compared to NOK 802 (95% CI NOK 641-962) in the AH group (p = 0.026).

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#### Hospital-at-Home (HaH) interventions (Appendix 4)

Eight of the HaH studies were focused on specific conditions: heart failure (n=3), chronic obstructive pulmonary disease (n=1), pulmonary embolism (n=1), pneumonia (n=1), stroke (n=1), and uncomplicated diverticulitis (n=1). <sup>20-28</sup> The remaining three HaH studies recruited older participants with a range of conditions, and two of these recruited from residential homes.<sup>29-33</sup> All the specific condition studies were included in recent (2010-2016) systematic reviews <sup>34-40</sup> but no relevant reviews for the older participants with a range of conditions were identified.

#### Heart failure (HF)

Three RCTs were identified on HaH for HF and their results published in four separate papers.<sup>20-23</sup> These studies were included in two previous reviews of HaH one which focused on HF (Quaddoura 2015).<sup>34,35</sup> This review used the Cochrane risk of bias tool and described the overall quality of the RCTs as modest. The AMSTAR rating of the review highlighted a lack of description of excluded studies and the combination of different QoL measures in meta-analysis.

In the Quaddoura systematic review the patients were randomised to either HaH or AH within the ED and the primary outcomes of the review were hospital readmissions and mortality. HaH increased time to first readmission (mean difference (MD) 14.13 days [95% CI 10.36, 17.91] p=0.015 using data from two RCTs (n=132).<sup>22-23</sup> although there was no strong evidence of an effect on the rate of readmission (RR 0.68 [0.42, 1.09]) using data from two RCTs (n=172).<sup>20,22</sup> This is a sizeable reduction, but consistent with chance in a data set of this size. An improvement was reported in health-related QoL at both 6 and 12 months

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(standardized MD (SMD) -0.31 [-0.45 to -0.18]; SMD -0.17 [-0.31 to -0.02] respectively). HaH was comparable to AH care on all-cause mortality (RR 0.94 (0.67, 1.32)) using data from all three RCTs. These studies also showed a significant reduction in costs for the index treatment period (p<0.001). Two trials<sup>20,23</sup> reported lower costs in the HaH group at 12 months, although the difference was not statistically significant in one of the studies.<sup>20</sup> When the authors of this particular review calculated total costs for these two trials, both indicated a cost reduction for HaH compared to AH care.

#### Chronic obstructive pulmonary disease (COPD)

An RCT by Ricauda was published in 2008 and was also included in two recent systematic reviews - one focusing on COPD and one more generally on HaH.<sup>24,35,36</sup> The high quality COPD review included eight RCTs, one of which described HaH in an early discharge setting, plus the Ricauda trial and six which were published prior to our 2005 inclusion date.

The Ricauda RCT compared HaH (n=52) with AH (n=52) and was conducted with low risk of bias. The primary outcomes were hospital readmission and mortality rates at 6 months. The secondary outcomes included a range of depression, functional, cognitive and nutritional measures as well as costs.

The study showed that there were fewer hospital readmissions for HaH patients compared to AH patients at 6 months (42% vs 87%, p=0.001) although HaH patients had a longer length of stay than those in the AH group (15.5 SD±9.5 vs 11.0 ±SD 7.9 days, p=0.01). Whilst HaH patients experienced improvements in depression and QoL scores during the study, there was no evidence of difference between the two

groups for these outcomes at 6 months. Cumulative mortality at 6 months was comparable between groups (20.2%).

All patients discharged from HaH completed the care programme at home, whereas 11.5% of AH patients continued their care in a long-term facility after hospital discharge, with an average daily cost of \$174.7 for a mean period of 25  $\pm$ 8.7 days. Overall - on a cost per patient per day basis - HaH care was less expensive than that given to the AH group (\$101.4  $\pm$  61.3 vs \$151.7  $\pm$ 96.4, p=0.002). This RCT reflected the results of the published systematic review.<sup>36</sup>

#### Pulmonary embolism

Our review identified one published nRCT of HaH (Rodriguez-Cerillo 2009) for patients with pulmonary embolism which was also included in a recent systematic review with seven other observational studies (Vinson 2012).<sup>25,37</sup> The high quality review concluded that the overall incidence of mortality at 90 days was very low.

The nRCT compared HaH (n=30) with AH (n=31) and was at high risk of bias overall.<sup>25</sup> No distinctions between primary and secondary outcomes were made. Mean length of stay was not statistically different comparing HaH with the AH group (8.9 days (7–14 days) vs. 10.6 days (6–20 days)). No patients treated at home required unexpected return to hospital during admission. There was no major bleeding, thrombosis or death in either group at 90 days in the nRCT.<sup>25</sup> There were no cost data reported.

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#### Pneumonia

Our review identified one RCT (Carratala 2005) published and included in a recent systematic review (Chalmers 2011) which also described a further five studies comprising a variety of designs).<sup>26,38</sup> The RCT compared HAH (n=110) with AH (n=114) and was at low risk of bias. The primary outcome was the percentage of patients with an 'overall successful outcome' according to seven predefined criteria<sup>26</sup> whilst secondary outcomes were patients' QoL and satisfaction.

An overall successful outcome was achieved in 83.6% of HaH patients and 80.7% of AH patients (absolute difference 2.9% [95% CI, 7.1-12.9]). Subsequent hospital admissions were comparable between groups (6.3 vs. 7.0%). More HaH patients were satisfied with their overall care (91.2 vs. 79.1%; ab 12.1% [CI, 1.8 to 22.5%]). Reported QoL scores were comparable between groups as was the percentage of patients with adverse drug reactions (9.1 vs. 9.6%), medical complications (0.9 vs. 2.6%), and overall mortality (0.9 vs. 0%) for HAH and AH patient groups respectively. There were no cost data presented. This RCT data reflects the result of the systematic review by Chalmers 2011.<sup>38</sup>

#### Stroke

One RCT on HaH for stroke patients (Kalra 2005) was published and also included in two previous systematic reviews.<sup>27,35,39</sup> This RCT was at low risk of bias. The primary outcome measure was death or institutionalisation at one year. This threearm study randomised patients into care on a stroke unit (SU) (n=152), care in a general ward (GW) with stroke expert advice (n=152) and HaH with stroke expert advice (n=153) within 72 hours after recruitment in the ED department.

Mortality and institutionalisation at one year were lower in the SU group compared with either the GW (14 vs. 30%, p < 0.001) or HaH groups (14 vs. 24%, p=0.03). Significantly fewer patients cared for on the SU died compared with those in the GW group (9 vs. 23%, p = 0.001). The SU group showed greater improvement on basic activities of daily living compared with the other two groups (change in Barthel Index 10 vs. 7, p < 0.002). QoL at three months was significantly better in SU and HaH patients. There was greater dissatisfaction with care in the GW group compared with SU or HaH groups. The total costs of stroke care per patient over 12 months (data collected 2005-2008) were £11,450 for the SU group, £9527 for GW group and £6840 for HaH group.

### Uncomplicated diverticulitis

Our systematic review found one nRCT(Rodriguez-Cerrillo 2013).<sup>28</sup> This study was also included in a recent, moderate quality integrative review on admission-avoidance HaH services.<sup>40</sup> This nRCT compared HaH (n=34) with AH (n=18) for patients with uncomplicated diverticulitis and was, overall, at high risk of bias with no defined primary or secondary outcomes were defined. No statistical detail was provided about any of the data presented. None of the patients treated at home were transferred to the acute hospital. The mean length of stay in the intervention group was 9 days, compared with 10 days in AH. HaH treatment was associated with a cost reduction of €1368 per patient.

#### Older population with acute medical problems

There were three studies identified published over five papers<sup>29-33</sup> and no relevant recent systematic reviews. One nRCT recruited acutely ill older persons and was published across three separate papers (Leff 2005, main publication).<sup>29-31</sup> This nRCT

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compared HaH (n=169) with AH (n=286) with the majority of patients being identified the morning after admission. The study was at high risk of bias.<sup>29</sup> There was no distinction made between primary and secondary outcomes. Patients treated with HaH had a shorter length of stay compared with those given AH care (3.2 vs. 4.9 days, p =0.004). The mean treatment cost was lower for HaH care than for acute hospital care (\$5081 vs. \$7480, p< 0.001). Eight weeks after admission, there were no differences in the use of health services between HaH and AH patients in terms of ED visits, (0.23 (SD 0.66) 0.22 (SD 0.57)) or readmission (0.28 (SD 0.59) 0.27 (SD 0.55)).

The nRCT by Crilly 2010 recruited elderly nursing home patients presenting at ED but who were willing to receive care back in their nursing home (n=62) and compared these with historical control care home patients who had been hospitalised (n=115). The study was at high risk of bias <sup>32</sup> and no primary outcomes were specified. Intervention participants experienced a longer time in ED than those who had been admitted into hospital (9.94 vs. 7.01 hours p=0.005) but required less time being subsequently cared for (2.19 vs. 6.2 days p<0.001). Overall, the length of an episode of care in days (9.56 (1.26) vs. 6.20 (0.59) days, p=0.14) and the number of readmissions within 28 days (11.3 vs. 11.3, p=0.99) were not statistically different between the two groups. There were no mortality or cost data presented.

The nRCT by Lau 2013 assessed residents of a care home presenting at ED who were subsequently treated back in their care home (n=95) and compared data with historical hospital controls i.e. not from care homes (n=167).<sup>33</sup> No primary outcomes were specified and the study was at high risk of bias. Length of stay was significantly shorter for those in the intervention group compared with the controls (2.0 vs. 11.0

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days p<0.001) although mortality (11 (11.6%) vs. 20 (12.0%), p=0.924) and readmission rates (39 (41.1%) vs. 68 (40.7%), p=0.963) at 6 months were comparable between groups. There were no cost data presented.

# Characteristics of those older patients for whom the decision to admit to hospital may be unclear (Appendix 6)

Fifteen of the studies included in our systematic review recruited a population with a mean age of more than 75 years, despite the inclusion criterion specifying those over 65 years. Whilst 9/19 studies specifically stated their recruited population was multi-morbid, it is plausible that all the study populations were and so this is very likely to be a factor which impacts on decision-making in acute medical care. Eight studies specified a particular degree of severity for dementia as an inclusion criterion but, in practice, this is a difficult assessment to make in the acute care context. There were inclusion/exclusion criteria in nine of the studies which specified the importance taking account of an individual's home situation, social support networks and coping abilities as part of the decision-making process.

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#### Discussion

#### Summary of principal findings

The findings of our systematic review show that alternatives to acute hospital care at the point of potential admission for people aged over 65 years can be safe, with comparable mortality and clinical outcomes across a range of acute and chronic conditions. They also have the potential to reduce healthcare spending. The exception to the evidence of benefit of HaH is the treatment of stroke patients, who fare much worse with HaH intervention compared to treatment in a stroke unit. The authors of this study suggest that these differences are due to the overall expertise available in the stroke unit as opposed to care given by generic hospital or homecare staff advised by specialised stroke health professionals. It is recommended therefore that in most cases, in line with current NHS practice for stroke, care should to be provided in specialist units.<sup>41</sup> The key features of older patients for whom the decision to admit may be uncertain are age more than 75 years, co/multi-morbidities, dementia, home situation, social support and individual coping abilities.

#### Comparison with previous literature

As part of our systematic review, any relevant systematic review published in 2010-2016 was included and referred to when discussing the more recent studies. All of these reviews were on the topic of HaH interventions. In addition to being older evidence, some of the previous reviews in contrast to our own included a number of uncontrolled observational studies. Some also included studies in which HaH interventions were applied in the non-emergency or post-discharge settings. By contrast, our systematic review focuses on bringing together controlled studies on

alternatives to acute hospitalisation at the point of potential admission for the over 65s.

#### Clinical and research implications

For health professionals, making a decision to admit an older patient can prove very difficult. Decision-making for each individual patient draws upon a range of professional experience and expertise, and should also be influenced by broader factors such as living conditions and individual/family/carer coping, in addition to care preferences. If alternatives to acute admission are available, health professionals must be confident about using these alternative pathways for their patients<sup>5</sup> and whilst many of the interventions in this review may provide viable alternatives to acute care, they may not exist in some healthcare communities or geographical regions. Nevertheless, our review suggests that where established alternatives to admission exist, clinicians should offer these with a degree of confidence and not assume that hospital admission is always the best or safest option for their patient. Future research should aim to provide more comprehensive evidence of both the clinical and cost effectiveness of a wider range of hospital alternatives for a greater range of health issues, as well as exploring in more detail the determinants and outcomes of decision-making under conditions of uncertainty. Many of the studies included in this review recruited highly defined populations and it would be helpful to understand whether the findings can be replicated in more general patient groups. There is also much to be done to improve the collection of data on patient-related outcomes, carer and health professional acceptability, and costs.

#### Strengths and limitations of review

Our systematic review was conducted to high methodological standards.<sup>42</sup> The majority of evidence presented is based on HaH services, although this includes

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treatment of a wide range of conditions. Whilst not all the included studies were randomised or considered to be at low risk of bias, these issues are clearly highlighted and the included studies cover a variety of alternative approaches to hospital admission. The majority of the included studies offer little or no cost data which makes it difficult to assess the cost-effectiveness of any these alternatives to acute hospital care. Whilst writing our protocol we planned to carry out a meta-analysis on suitable data. However, the data we identified were insufficient, in terms of quantity (i.e. often drawn from a single study), quality (i.e. from nRCT) or homogeneity. Where sufficient data were identified - on HaH for heart failure – an analysis had already been conducted within a previous review.<sup>34</sup>

In conclusion, this systematic review describes and assesses evidence on alternatives to acute care for older patients and shows that many of the options available are safe and appear to reduce resource use.

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## **Competing interests**

None of the authors have any competing interests to declare

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### Authors' contribution

**ALH** Research Fellow and lead systematic reviewer conducting all stages of the review and responsible for the initial draft of paper.

**MC** Research Fellow with specific expertise in Patient and Public Involvement (PPI) as well as older age community care. Contributing to discussion as the review progressed. Commenting and editing on the drafts of the paper.

**AH** Senior Research Fellow with specific expertise in patient-related outcomes. Contributing to discussion as the review progressed. Commenting and editing on the drafts of the paper.

**WH** Professor with specific expertise in health economics. Contributing to discussion as the review progressed. Commenting and editing on the drafts of the paper.

**CM** Reader with specific expertise in trial design and statistical analysis. Contributing to discussion as the review progressed. Commenting and editing on the drafts of the paper.

**JB** Professor with specific expertise in emergency care. Contributing to discussion as the review progressed. Commenting and editing on the drafts of the paper.

SP Principal Investigator and Professor with specific expertise in primary health care.

Third reviewer of data. Commenting and editing on the drafts of the paper.

#### Data sharing statement

This is a systematic review and all the data we have collected is either in the main text and summary table or in the on-line appendices.

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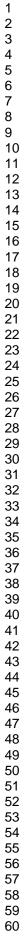
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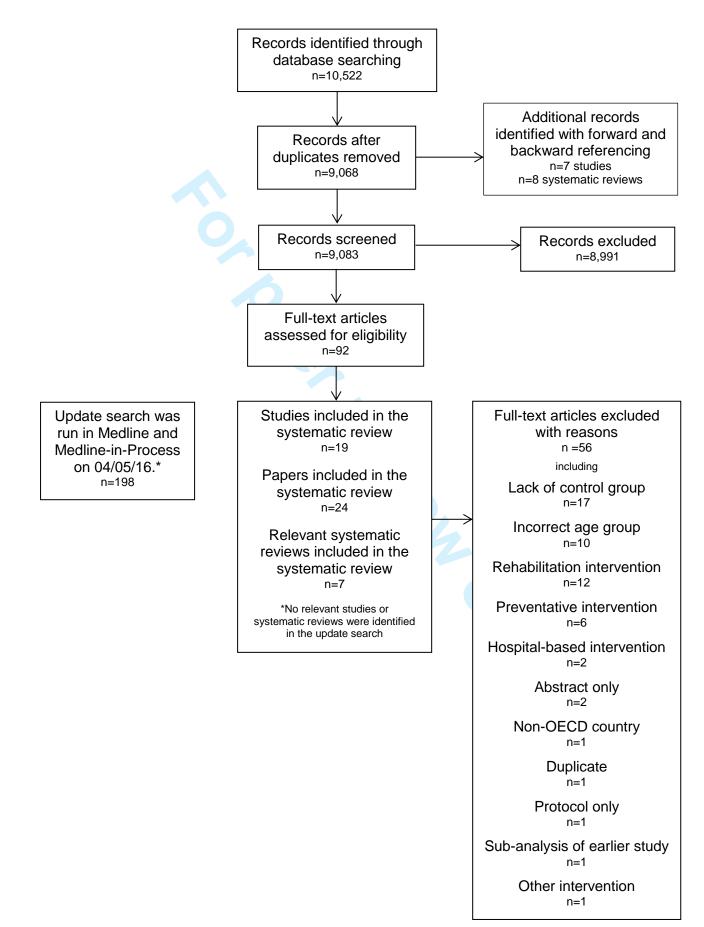
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## **PRISMA** flow diagram





## Appendix 1: Parent search strategy run in Medline

Database: Medline In-process - current week, Medline 1950 to present

Search Strategy: Run April 24th 2015

- 1 intervention?ti. or (intervention? adj6 (clinician? or collaborat\$ or community or complex or DESIGN\$ or doctor? or educational or family doctor? or family physician? or family practitioner? or financial or GP or general practice? or hospital? or impact? or improv\$ or individuali?e? or individuali?ing or interdisciplin\$ or multicomponent or multi-component or multidisciplin\$ or multi-disciplin\$ or multifacet\$ or multi-facet\$ or multimodal\$ or multi-modal\$ or personali?e? or personali?ing or pharmacies or pharmacist? or pharmacy or physician? or provider? or regulatory or regulatory or tailor\$ or target\$ or team\$ or usual care)).ab. (178760)
- 2 (pre-intervention? or preintervention? or "pre intervention?" or post-intervention? or post-intervention?").ti,ab. (11719)
- 3 (hospital\$ or patient?).hw. and (study or studies or care or health\$ or practitioner? or provider? or physician? or nurse? or nursing or doctor?).ti,hw. (747131)
- 4 demonstration project?.ti,ab. (2027)
- 5 (pre-post or "pre test\$" or pretest\$ or posttest\$ or "post test\$" or (pre adj5 post)).ti,ab. (72037)
- 6 (pre-workshop or post-workshop or (before adj3 workshop) or (after adj3 workshop)).ti,ab. (653)
- 7 trial.ti. or ((study adj3 aim?) or "our study").ab. (697929)
- 8 (before adj10 (after or during)).ti,ab. (375455)
- 9 ("quasi-experiment\$" or quasiexperiment\$ or "quasi random\$" or quasirandom\$ or "quasi control\$" or quasicontrol\$ or ((quasi\$ or experimental) adj3 (method\$ or study or trial or design\$))).ti,ab,hw. (107858)
- 10 ("time series" adj2 interrupt\$).ti,ab,hw. (1212)
- 11 (time points adj3 (over or multiple or three or four or five or six or seven or eight or nine or ten or eleven or twelve or month\$ or hour? or day? or "more than")).ab. (10245)
- 12 pilot.ti. (43282)
- 13 Pilot projects/ (86631)
- 14 (clinical trial or controlled clinical trial or multicenter study).pt. (644558)
- 15 (multicentre or multicenter or multi-centre or multi-center).ti. (31588)

- random\$.ti,ab. or controlled.ti. (809402)
- (control adj3 (area or cohort? or compare? or condition or design or group? or intervention? or participant? or study)).ab. not (controlled clinical trial or randomized controlled trial).pt. (440969)
- Aged/ (2394306)
- "Aged, 80 and over"/ (647729)
- older adults.mp. (38411)
- elderly adults.mp. (2417)
- over 65 years.mp. (3421)
- virtual ward.mp. (12)
- intermediate care.mp. (1478)
- Crisis response.mp. (103)
- Crisis resolution.mp. (99)
- reablement.mp. (12)
- re-ablement.mp. (11)
- hospital care at home.mp. (14)
- hospital-at-home.mp. (289)
- home hospital.mp. (150)
- medical day hospital care.mp. (2)
- day hospital.mp. (2435)
- out-patient facility.mp. (13)
- Domiciliary care.mp. (247)
- intermediate services.mp. (7)
- Intermediate Care Facilities/ (639)
- Home Care Services, Hospital-Based/ (1662)
- Home Health Nursing/ (58)
- Home Nursing/ (8049)
- admission avoidance.mp. (56)
- outreach program.mp. (677)
- hospital outreach.mp. (27)
- nursing-led units.mp. (3)
- hospital in home.mp. (8)
- hospital in the home.mp. (123)
- medical home care.mp. (39)

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3	48	Crisis intervention service.mp. (31)
4 5	49	Geriatric emergency management practice model.mp. (1)
6 7		day unit.mp. (169)
8	50 51	Day Care/ (4670)
9 10		
11 12	52	day centre.mp. (170)
13	53	comprehensive elderly care.mp. (2)
14 15	54	Substitutive care.mp. (1)
16 17	55	shared care.mp. (916)
18	56	guided care.mp. (69)
19 20	57	home-based versus hospital-based.mp. (11)
21 22	58	home hospitalisation.mp. (28)
23 24	59	rapid response team.mp. (515)
25	60	rapid response nurse.mp. (2)
26 27	61	Hospitals, Community/ (10479)
28 29	62	*Ambulatory Care/ (15963)
30	63	*Health Services for the Aged/ (12112)
31 32	64	or/1-17 (3278427)
33 34	65	or/23-63 (57831)
35 36	66	or/18-22 (2428347)
37	67	64 and 65 and 66 (11288)
38 39	68	67 not (child/ or infant/ or adolescent/ or maternal health services/) (9807)
40 41 42 43 44 45	69	68 not (case report/ or case study/ or letter/ or editorial/ or expert opinion.mp.) [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier] (9192)
46 47 48 49 50 51 52 53 54 55 56 57 58 59 60	70	69 not (Algeria\$ or Egypt\$ or Liby\$ or Morocc\$ or Tunisia\$ or Western Sahara\$ or Angola\$ or Benin or Botswana\$ or Burkina Faso or Burundi or Cameroon or Cape Verde or Central African Republic or Chad or Comoros or Congo or Djibouti or Eritrea or Ethiopia\$ or Gabon or Gambia\$ or Ghana or Guinea or Keny\$ or Lesotho or Liberia or Madagasca\$ or Malawi or Mali or Mauritania or Mauritius or Mayotte or Mozambiq\$ or Namibia\$ or Niger or Nigeria\$ or Reunion or Rwand\$ or Saint Helena or Senegal or Seychelles or Sierra Leone or Somalia or South Africa\$ or Sudan or Swaziland or Tanzania or Togo or Ugand\$ or Zambia\$ or Zimbabw\$ or China or Chinese or Hong Kong or Macao or Mongolia\$ or Taiwan\$ or Belarus or Moldov\$ or Russia\$ or Ukraine or Afghanistan or Armenia\$ or Azerbaijan or Bahrain or Cyprus or Cypriot or Georgia\$ or Iran\$ or Iraq\$ or Israel\$ or Jordan\$ or Kazakhstan or Kuwait or Kyrgyzstan or Leban\$ or Oman or Pakistan\$ or Palestin\$ or Qatar or Saudi Arabia or Syria\$ or Tajikistan or Turkmenistan or United Arab Emirates

or Uzbekistan or Yemen or Bangladesh\$ or Bhutan or British Indian Ocean Territory or Brunei Darussalam or Cambodia\$ or India\$ or Indonesia\$ or Lao or People's Democratic Republic or Malaysia\$ or Maldives or Myanmar or Nepal or Philippin\$ or Singapore or Sri Lanka or Thai\$ or Timor Leste or Vietnam or Albania\$ or Andorra or Bosnia\$ or Herzegovina\$ or Bulgaria\$ or Croatia\$ or Estonia or Faroe Islands or Greenland or Liechtenstein or Lithuani\$ or Macedonia or Malta or maltese or Romania or Serbia\$ or Montenegro or Slovenia or Svalbard or Argentina\$ or Belize or Bolivia\$ or Brazil\$ or chile or Chilean or Colombia\$ or Costa Rica\$ or Cuba or Ecuador or El Salvador or French Guiana or Guatemala\$ or Guyana or Haiti or Honduras or Jamaica\$ or Nicaragua\$ or Panama or Paraguay or Peru or Puerto Rico or Suriname or Uruguay or Venezuela or developing countr\$ or south America\$).ti,sh. (8719)

- 71 admission\*.ab. (140603)
- 72 hospital\*.ab. (747796)
- 73 71 or 72 (804011)

- 74 70 and 73 (3851)
- 75 limit 74 to yr="2005 -Current" (1880)
- 76 remove duplicates from 75 (1829)

## Appendix 2: EPOC Risk of bias

## Paramedic (PP) / emergency care practitioner (ECP) interventions

#### Study: Mason 2007 RCT - older population with mixed conditions

Bias	Authors' judgement	Support for judgement	
Was allocation sequence adequately generated?	Low risk	We used cluster randomisation to reduce the risk of contamination (practice in the control group being influenced by the presence of the paramedic practitioner in the community) and to allow service level, rather than individual patient level, evaluation of the intervention. Weeks were randomised before the start of the study (to allow for rostering of the parametic practitioners) to the paramedic practitioner service being active (intervention) or inactive (control), when the standard 99 service was available'	
Was allocation adequately concealed?	Low risk	'Episode of care with some form of centralised randomisation scheme'	
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. ED attendance	
Were baseline characteristics similar?	Low risk	Baseline characteristics of intervention and control groups were reported and similar	
Were incomplete outcome data adequately addressed?	Low risk	Flow of patients through trial was presented and intention-to-treat analysis used	
Was knowledge of allocated interventions adequately prevented during study?	Low risk	Majority of outcomes were objective but there was one about satisfaction with service i.e. subjective	
Was study adequately protected against contamination?	Low risk	'We used cluster randomisation to reduce the risk of contamination (practice in the control group being influenced by the presence of the paramedic practitioner in the community) and to allow service level, rather than individual patient level, evaluation of the intervention'.	
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section	
Was study free from other risks of bias?	Low risk	Nothing obvious	

#### Study: Gray 2008 historical controls - older people with falls

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	High risk	'From January to April 2006 inclusive, all the patients seen by the ECP service who had rung 999 with a diagnosis of either breathing difficulties or an elderly patient (.65 years of age) with a fall were reviewed.' 'Comparison data were taken from January to April 2005 inclusive for attendances to the same ED for patients with the same criteria as above seen by non- ECP ambulance service personnel'
Was allocation adequately concealed?	High risk	As above
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. ED attendance
Were baseline characteristics similar?	Unclear risk	No details given other than 'elderly patients >65yrs with a fall'
Were incomplete outcome data adequately addressed?	Unclear risk	No reference to missing data or how it might be handled
Was knowledge of allocated interventions adequately prevented during study?	Low risk	Outcome measures were all objective
Was study adequately protected against contamination?	Low risk	Different data collection time-periods were reported for each group
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Only used half of the study population

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	High risk	'Potential 'intervention' trust sites were selected on the basis of their heterogeneity of service delivery of ECP care. 'Contro trust sites that did not employ ECPs, but were in close geographical proximity (i.e. within the same or in a neighbouring county) and which offered the same service configurations as the intervention trusts, were then selected'
Was allocation adequately concealed?	High risk	As above
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. ED attendance
Were baseline characteristics similar?	High risk	For the care home subgroup, figures were given on selected baseline characteristics but no formal comparison appeared t be made. On face value, clinical characteristics were not balanced e.g. adult medical 30 vs.41%, adult trauma 46 vs.13%
Were incomplete outcome data adequately addressed?	Unclear risk	No reference to missing data or how it might be handled
Was knowledge of allocated interventions adequately prevented during study?	Low risk	Outcome measures were all objective
Was study adequately protected against contamination?	Low risk	Intervention and control were delivered in different locations
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Nothing obvious

## **Emergency Department (ED) interventions**

#### Study: Sun 2014 RCT - syncope

Bias	Authors' judgement	Support for judgement		
Was allocation sequence adequately generated?	Low risk	'Patients were block randomized (n=4) by site in a 1:1 ratio to either the observation protocol or routine inpatient admission'		
Was allocation adequately concealed?	Low risk	'A computer generated the study arm assignment at randomization, and no research personnel had advance knowledge of study arm assignment. We could not blind this health service intervention to patients, providers, or research personnel.'		
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. inpatient admission rates		
Were baseline characteristics similar?	Low risk	Baseline characteristics of intervention and control groups were reported and similar		
Were incomplete outcome data adequately addressed?	Low risk	Flow chart of participants provided and intention-to-treat analysis performed		
Was knowledge of allocated interventions adequately prevented during study?	Low risk	Outcome measures were objective but one secondary outcome - participant satisfaction – was subjective		
Was study adequately protected against contamination?	Unclear risk	Treatment and control were allocated and delivered in same location so possible for participants to swap allocation		
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section		
Was study free from other risks of bias?	Low risk	Nothing obvious		

#### Study: Salvi 2008 CT - older population with mixed conditions

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	High risk	Trained research assistant (VM) screened patients presenting to the ED for Monday to Friday from 9:00 a.m to 6:00 p.m
	, i i i i i i i i i i i i i i i i i i i	using a standard information sheet explaining the study protocol to patients and proxies'
Was allocation adequately concealed?	High risk	As above
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. number of initial admissions
Were baseline characteristics similar?	High risk	Intervention and control groups were unbalanced - age, 78.1(7) vs.82.5(7.2) p<0.001, female 47 vs. 68% p=0.004, married
		70 vs. 40% p<0.001, SPMSQ 2.5(3.3) vs. 5.2(4.2) p<0.001, ADL4.3(2) vs. 3.2(2.5) p=0.001
Were incomplete outcome data adequately addressed?	Unclear risk	No reference to missing data or how it might be handled
Was knowledge of allocated interventions adequately prevented during study?	Low risk	All outcome measures were objective
Was study adequately protected against contamination?	Unclear risk	Treatment and control were delivered in different locations
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Nothing obvious
	•	
Study: Benaiges 2014 CT - hyperglycaemia		

#### Study: Benaiges 2014 CT - hyperglycaemia

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	High risk	'Patients were assigned to the DH group if they were admitted to hospital within DH opening hours (weekdays from 8:00 a.m to 4:00 p.m); otherwise they were treated in the emergency department and subsequently hospitalized'
Was allocation adequately concealed?	High risk	As above
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. number of ER visits
Were baseline characteristics similar?	Low risk	Baseline characteristics of treatment and control groups were reported and similar
Were incomplete outcome data adequately addressed?	Unclear risk	No reference to missing data or how it might be handled
Was knowledge of allocated interventions adequately prevented during study?	Low risk	All outcome measures were objective
Was study adequately protected against contamination?	Low risk	'Patients were treated with same protocol for both DH and CH' so contamination was possible
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Nothing obvious

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## Community hospital interventions

#### Study: Vicente 2014 RCT

Bias	Authors' judgement	Support for judgement		
Was allocation sequence adequately generated?	Low risk	'The dispatchers at the EMCC randomized older adults into the study. A sealed envelope randomization procedure wa initiated when the dispatcher received the incoming call and identified the participant as an individual aged 65 who res in the specified geographical area and was assigned a priority level 2 or 3, and the call occurred between 8:00 a.m. an 10:00 p.m'		
Was allocation adequately concealed?	Low risk	'The envelope contained the name of the EMS Company 1 or the name of the EMS Company 2. There was an equal chance (1:1) of being assigned to either of the ambulance companies'		
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. number of individuals sent direct to community hospital		
Were baseline characteristics similar?	High risk	There was a difference in the priority level when ambulance sent out (% individuals) – Level 1) 1.6 vs. 0%, Level 2) 59 vs. 47%, Level 3) 39 vs.53%, p=0.001		
Were incomplete outcome data adequately addressed?	Unclear risk	No reference to missing data or how it might be handled		
Was knowledge of allocated interventions adequately prevented during study?	Low risk	All outcome measures were objective		
Was study adequately protected against contamination?	Low risk	Separate sealed envelope opened for each individual case		
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section		
Was study free from other risks of bias?	Low risk	Nothing obvious		

## Study: Garasen 2007/8 ab RCT - older population with mixed conditions

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	Low risk	'When an eligible patient was identified and accepted for inclusion, a blinded randomisation was performed by the Clinical Research Department using random number tables in blocks to ensure balanced groups'
Was allocation adequately concealed?	Low risk	As above
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. number of readmissions for index disease
Were baseline characteristics similar?	Unclear risk	Baseline characteristics of intervention and control groups were described but no formal comparison reported
Were incomplete outcome data adequately addressed?	Unclear	No reference to missing data or how it might be handled
Was knowledge of allocated interventions adequately prevented during study?	Low risk	All outcome measures were objective
Was study adequately protected against contamination?	Low risk	Participants were allocated using a clear process but 8 individuals originally assigned to CH were later assigned to GH
Was study free from selective outcome reporting?	Low risk	All outcomes described in methods section were reported in results section plus 12-month data was used in Garasen 2008
Was study free from other risks of bias?	Low risk	Nothing obvious

## Hospital-at-Home (HAH) interventions: heart failure

#### Study: Patel 2008 pilot RCT - heart failure

Was study free from selective outcome reporting?	Low risk	All outcomes described in methods section were reported in results section plus 12-month data was used in Garasen 2008
Was study free from other risks of bias?	Low risk	Nothing obvious
Hospital-at-Home (HAH) interventions: heart	failure	
Study: Patel 2008 pilot RCT - heart failure		
Bias	Authors' judgement	Support for judgement
	Authors' judgement	Support for judgement
Bias Was allocation sequence adequately generated? Was allocation adequately concealed?	Low risk	Open pilot RCT
Was allocation sequence adequately generated? Was allocation adequately concealed? Were baseline outcome measurements similar?	Low risk Unclear risk	Open pilot RCT Used 'random number generator under direction of specialist nurse or hospital admission staff' but no further detail provided
Was allocation sequence adequately generated? Was allocation adequately concealed? Were baseline outcome measurements similar? Were baseline characteristics similar?	Low risk Unclear risk Low risk	Open pilot RCT Used 'random number generator under direction of specialist nurse or hospital admission staff' but no further detail provided Mostly not relevant since majority of outcomes were related to process Baseline characteristics of intervention and control groups were reported and small differences seen in gender, education
Was allocation sequence adequately generated? Was allocation adequately concealed? Were baseline outcome measurements similar? Were baseline characteristics similar? Were incomplete outcome data adequately addressed?	Low risk Unclear risk Low risk Low risk	Open pilot RCT Used 'random number generator under direction of specialist nurse or hospital admission staff' but no further detail provided Mostly not relevant since majority of outcomes were related to process Baseline characteristics of intervention and control groups were reported and small differences seen in gender, education and two particular co-morbidities
Was allocation sequence adequately generated? Was allocation adequately concealed? Were baseline outcome measurements similar? Were baseline characteristics similar? Were incomplete outcome data adequately addressed? Was knowledge of allocated interventions adequately prevented during study?	Low risk Unclear risk Low risk Low risk High risk	Open pilot RCT Used 'random number generator under direction of specialist nurse or hospital admission staff' but no further detail provided Mostly not relevant since majority of outcomes were related to process Baseline characteristics of intervention and control groups were reported and small differences seen in gender, education and two particular co-morbidities Flow of patients was described although description of analysis was lacking
Was allocation sequence adequately generated? Was allocation adequately concealed?	Low risk Unclear risk Low risk Low risk High risk Unclear risk	Open pilot RCT Used 'random number generator under direction of specialist nurse or hospital admission staff' but no further detail provided Mostly not relevant since majority of outcomes were related to process Baseline characteristics of intervention and control groups were reported and small differences seen in gender, education and two particular co-morbidities Flow of patients was described although description of analysis was lacking No detail provided

#### Study: Mendoza 2009/Garcia-Soleto 2013 RCT - heart failure

Bias	Authors' judgement	Support for judgement	
Was allocation sequence adequately generated?	Low risk	'Randomly assigned (1:1) to one of the intervention groups according to an externally generated sequence, which was	
		hidden from the clinicians until the patient had given consent to participate'	
Was allocation adequately concealed?	Low risk	As above	
Were baseline outcome measurements similar?	Low risk	Mostly not relevant since outcomes were related to process but functional status and health-related QoL were similar	
Were baseline characteristics similar?	Low risk	Baseline characteristics of intervention and control groups were reported and similar	
Were incomplete outcome data adequately addressed?	Low risk	Patient flow through trial was described and 'per protocol' analysis performed	
Was knowledge of allocated interventions adequately prevented during study?	Unclear risk	No detail provided	
Was study adequately protected against contamination?	Low risk	Treatment and control were delivered in different locations	
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section	
Was study free from other risks of bias?	Low risk	Nothing obvious	

# Study: Tibaldi 2009 RCT - heart failure

Low risk	'By the use of a set of computer-generated random numbers in a 1:1 ratio. The allocation sequence was unknown to any of the investigators and was contained in a set of sealed envelopes, each bearing on the outside only the name of the hospital and a number, which was opened after the acceptance of the patient'
Low risk	and a number, which was opened after the acceptance of the patient'
Low risk	
Low risk	
	Participants were enrolled within 12-24 hours of ED admission by research assistants, masked to both allocation and
	hypotheses being tested
Low risk	Mostly not relevant since outcomes were related to process but depression, function and nutrition measures were similar
Unclear risk	Baseline characteristics of intervention and control groups were reported and heart rate was significantly different p=0.006
Low risk	Patient flow through trial described and intention-to-treat analysis performed
Unclear risk	No detail available
Low risk	Treatment and control were delivered in different locations
Low risk	All outcome measures described in methods section were reported in results section
Low risk	Nothing obvious
•	
	Low risk Unclear risk Low risk Unclear risk Low risk Low risk

## Hospital-at-Home (HAH): COPD

#### Study: Ricauda 2008 RCT - COPD

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	Low risk	Patients were randomised using a set of computer-generated random numbers in a 1:1 ratio.
Was allocation adequately concealed?	Low risk	Allocation sequence was unknown to any of the investigators and kept in a set of sealed envelopes, each bearing on the outside only the name of the hospital and a number. After acceptance of a patient, the ED nurse coordinator, who was not involved in the study, opened the appropriately numbered envelope
Were baseline outcome measurements similar?	Low risk	Mostly not relevant since outcomes were related to process but clinical outcomes e.g. depression were similar
Were baseline characteristics similar?	Low risk	Recorded in DE table
Were incomplete outcome data adequately addressed?	Low risk	Drop outs/loss-to-follow-up were recorded and intention-to-treat analysis performed
Was knowledge of allocated interventions adequately prevented during study?	Unclear risk	Single-blind study since patients were aware of the treatment assignment although physicians and nurses evaluating patients were blinded to the patient's allocation
Was study adequately protected against contamination?	Low risk	Treatment and control were delivered in different locations
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Nothing obvious

## Hospital-at-Home (HAH): Pulmonary embolism

#### Study: Rodriguez-Cerillo 2009 nRCT - non-massive pulmonary embolism

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	High risk	nRCT
Was allocation adequately concealed?	High risk	nRCT
Were baseline outcome measurements similar?	Low risk	Mostly not relevant since outcomes were related to process
Were baseline characteristics similar?	Low risk	Baseline characteristics of treatment and control groups were reported and only difference was prior thromboembolic disease, with these cases all being allocated to hospital
Were incomplete outcome data adequately addressed?	High risk	No patient flow or analysis was described
Was knowledge of allocated interventions adequately prevented during study?	High risk	nRCT
Was study adequately protected against contamination?	Low risk	Clinical decision-making at study entry and any subsequent changes were recorded - although none made in practice
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	High risk	Reported some 'external' decision-making
Hospital-at-Home (HAH): Pneumonia		
Study: Carratala 2005 open RCT - pneumonia		
Rias	Authors' judgement	Support for judgement

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	Low risk	Randomisation was performed by using a computer-generated random code with a block size of 10
Was allocation adequately concealed?	Low risk	Randomisation was stratified by hospital site, and the random code was held centrally, in a sealed envelope, by the clinical epidemiologist. In the emergency department, the infectious disease consultant (in most cases not a study investigator) opened sealed, sequentially numbered opaque envelopes to randomly assign patients who had provided written informed consent and met the study criteria
Were baseline outcome measurements similar?	Low risk	Mostly not relevant since outcomes were related to process
Were baseline characteristics similar?	Low risk	Detailed in DE table
Were incomplete outcome data adequately addressed?	Low risk	Patient flow through trial was reported and intention-to-treat analysis performed
Was knowledge of allocated interventions adequately prevented during study?	Unclear risk	Trial was described as 'unblinded '
Was study adequately protected against contamination?	Low risk	Treatment and control were delivered in different locations
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Unclear risk	Lack of blinding in terms of assessment could be problematic
Hospital-at-Home (HAH): Stroke Study: Kalra 2005 RCT - stroke		07/
Bias	Authors' judgement	Support for judgement

## Hospital-at-Home (HAH): Stroke

#### Study: Kalra 2005 RCT - stroke

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	Low risk	Randomisation was not stratified and was undertaken using the block randomisation technique. This ensured that the number of patients allocated to the stroke unit or to domiciliary services at any one time did not exceed their capacity
Was allocation adequately concealed?	Unclear risk	Randomisation was conducted in blocks of 30 in an office remote from patient treatment areas, so that it would not be possible for those enrolling patients to guess allocation for the vast majority of subjects
Were baseline outcome measurements similar?	Low risk	Mostly not relevant since outcomes were related to process
Were baseline characteristics similar?	Low risk	Baseline characteristics with regard to stroke type, severity, level of impairment and initial disability were well-matched across the three groups
Were incomplete outcome data adequately addressed?	Low risk	Patient flow through trial was reported and intention-to-treat analysis performed
Was knowledge of allocated interventions adequately prevented during study?	Unclear risk	No detail provided
Was study adequately protected against contamination?	Unclear risk	Patients were brought to hospital from domiciliary care if that was considered to be clinically appropriate
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	High risk	In order to ensure that participants were treated in the most appropriate setting, swapping of groups was possible

## Hospital-at-Home (HAH): Uncomplicated diverticulitis

#### Study: Rodriguez-Cerrillo 2013 nRCT - uncomplicated diverticulitis

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	High risk	nRCT
Was allocation adequately concealed?	High risk	As above
Were baseline outcome measurements similar?	Low risk	Mostly not relevant since outcomes were related to process
Were baseline characteristics similar?	Low risk	Very limited details provided about age, gender and presenting complaint
Were incomplete outcome data adequately addressed?	High risk	No flow of patients was given and only basic analysis reported
Was knowledge of allocated interventions adequately prevented during study?	High risk	No detail provided
Was study adequately protected against contamination?	Low risk	Treatment and control were delivered in different locations
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Unclear risk	Both analysis and reporting of results were limited

## Hospital-at-Home (HAH): Mixed population

#### Study: Leff 2005/2009 'quasi experimental' - older population with mixed conditions

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	High risk	<sup>1</sup> During the acute care hospital observation phase (1 November 1990 to 30 September 2001), eligible patients were identified and followed through usual hospital care. <sup>1</sup> During the intervention phase (1 November 2001 to 30 September 2002), eligible patients were identified at the time of admission and were offered the option of receiving their care in hospital-at-home rather than in the acute care hospital'
Was allocation adequately concealed?	High risk	As above
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. time before evaluation
Were baseline characteristics similar?	High risk	Populations differed in measures of poverty, living alone and medication. This was acknowledged but not adjusted for.
Were incomplete outcome data adequately addressed?	Low risk	Intention-to-treat analysis was conducted although there were substantial missing data e.g. in relation to functional status
Was knowledge of allocated interventions adequately prevented during study?	Low risk	All outcomes were objective in Leff 2005 (main publication) but Leff 2009 used self-reported i.e. subjective daily activity of living as an outcome
Was study adequately protected against contamination?	Low risk	Unlikely that control group received intervention and vice versa. Rather, patients were allocated HaH or admitted and, if HaH was unacceptable they were admitted
Was study free from selective outcome reporting?	Low risk	All outcomes described in methods section were reported in results section. Whilst there is no mention of activities of daily living in Leff 2005, this outcome was reported in Leff 2009
Was study free from other risks of bias?	Unclear risk	Possible selection bias related to differences in baseline characteristics e.g. functional status

#### Study: Lau 2003 historical controls

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	High risk	Control trial with historical control group
Was allocation adequately concealed?	High risk	As above
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. palliative care received
Were baseline characteristics similar?	High risk?	There was an imbalance in patient characteristics which may have been due to recruitment bias since the provider was responsible for recruiting patients into the trial. There were more dementia patients treated outside of hospital – although presumably their symptoms were 'fairly mild' since more pronounced behavioural problems were excluded from HaH grou
Were incomplete outcome data adequately addressed?	Unclear risk	No reference to missing data or how it might be handled
Was knowledge of allocated interventions adequately prevented during study?	Low risk	All outcomes were objective
Was study adequately protected against contamination?	Low risk	Unlikely that control group received intervention and vice versa. Rather, patients were allocated HaH or admitted and, if HaH was unacceptable they were admitted
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Nothing obvious

#### Study name: Crilly 2010 'quasi experimental' - older population with mixed conditions

Bias	Authors' judgement	Support for judgement
Was allocation sequence adequately generated?	High risk	Intervention group included 62 Aged Care Facility (ACF) residents who were enrolled in the Hospital in Nursing home programme during the first 12 months that the programme was operational, from 1 July 2003–30 June 2004. All sample
		members were ACF residents who presented to the ED and were subsequently admitted to hospital
Was allocation adequately concealed?	High risk	As above
Were baseline outcome measurements similar?	Unclear risk	No baseline measure of outcomes since they were related to receiving intervention e.g. palliative care received
Were baseline characteristics similar?	Low risk	Baseline characteristics of the study and control are reported and similar
Were incomplete outcome data adequately addressed?	Unclear	No reference to missing data or how it might be handled
Was knowledge of allocated interventions adequately prevented during study?	Low risk	All outcomes were objective
Was study adequately protected against contamination?	Low risk	Unlikely that control group received intervention and vice versa. Rather, patients were allocated HaH or admitted and, if HaH was unacceptable they were admitted
Was study free from selective outcome reporting?	Low risk	All outcome measures described in methods section were reported in results section
Was study free from other risks of bias?	Low risk	Nothing obvious
		Nothing obvious

#### Appendix 3: AMSTAR ratings of systematic reviews

Study	Was an 'a priori' design provided?	Was there duplicate study selection and data extraction?	Was a comprehensive literature search performed?	Was the status of publication (i.e. grey literature) used as an inclusion criterion?	Was a list of studies (included and excluded) provided?	Were the characteristics of the included studies provided?	Was the scientific quality of the included studies assessed and documented?	Was the scientific quality of the included studies used appropriately in formulating conclusions?	Were the methods used to combine the findings of studies appropriate?	Was the likelihood of publication bias assessed?	Was the conflict of interest included?
Caplan 2012	YES	YES	YES	YES	NO excluded studies not listed	NO studies were grouped by medical, surgical, rehabilitation and psychiatric	YES	YES	YES	YES	YES
Chalmers 2011	YES	YES	YES	NO	NO excluded studies not listed	YES but no ages and no direct reporting of participants in either group	YES but not detailed and whilst Cochrane was cited only one RCT involved	YES	UNCLEAR difficult to judge whether combination of study types is commonly accepted	No	YES
Jeppensen 2012 (Cochrane)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Qaddoura 2015	YES	YES	YES	YES	NO excluded studies not listed	YES	YES	NO relatively high risk of bias but all available data used	NO meta-analysis of two RCTs plus combination of different QoL measures from same study in meta-analysis	NO	YES
Shepperd 2016 (Cochrane)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Varney 2014	YES	NO used single reviewer	YES	YES	NO	YES	YES	NO	N/A no data were combined	NO	YES
Vinson 2012	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	NO

## Appendix 4: description of interventions included in systematic review

Intervention	Description
Paramedic practitioner (PP) /	PPs/ECPs can be trained to 'assess and
emergency care practitioner (ECP)	treat' or to refer patients with a range of
interventions	conditions, as part of pre-hospital care.
	These roles were created in order to
	provide a more appropriate response to
	patients needs in emergency and urgent
	care settings. Their main purpose is to
	improve the pathway of care and patient
	experience, particularly by discharging
	patients at the scene or by referring on to
	the most appropriate care practitioner,
	reducing unnecessary emergency
	department (ED) attendance and avoidable admissions.
Community hospital (CH) interventions	The role of CHs varies between country
	and health systems but, essentially, their
	main role is to provide non-urgent i.e.
	routine or rehabilitative care. However,
	their role can be extended to provide an
	alternative to acute hospital (AH)
	admission for appropriate cases.
Emergency department (ED)	These involve initial assessment in the
interventions	ED, followed by an extended stay for test
	and observation. This extended stay is in
	a bed closely associated with the ED, if
	not part of it.
Hospital-at-home (HaH) interventions	HaH services provide acute or sub-acute
· · · · · ·	treatment in a patient's residence for a
	condition that would normally require
	admission to hospital. It is also known as
	'hospital in the home' and 'home
	hospitalisation'.
Hospital in nursing/care home (HNCH)	HNCH is as a model of admission
interventions	avoidance to treat patients living in
	nursing and residential care homes,
	working on the same principles as HaH for
	community-dwelling residents.

#### Appendix 6: Characteristics of those older patients for whom the decision to admit to hospital may be unclear

Patient characteristics	Studies which include such populations				
Age ≥75 years	15/19 studies				
for included patients	Mason 2007 & 2012; Benaiges 2014; Salvi 2008; Garasen 2007; Vincente 2014; Patel 2008; Mendoza 2009; Tibaldi 2009; Ricauda 2008; Kalra 2005; Rodriguez-Cerillo 2013; Leff 2005; Crilly 2010; Lau 2013				
Co/multi-morbidities	9/19 studies				
in included patients stated either by number of conditions or multi-morbidity score e.g. Charlson Score	Benaiges 2014; Salvi 2008; Patel 2008; Mendoza 2009; Tibaldi 2009; Ricauda 2008; Carratala 2005; Leff 2005; Lau 2013				
Dementia	a) 2/19 studies				
either stated in a) patient demographics or b) used as an exclusion criterion based on severity	Rodriguez-Cerillo 2009; Lau 2013				
	b) 8/19 studies				
	Mason 2007; Sun 2014; Salvi 2008; Garasen 2007; Mendoza 2009; Tibaldi 2009; Ricauda 2008; Lau 2013				
Social care support	3/19 studies				
stated in inclusion/exclusion criteria	Tibaldi 2009; Ricauda 2008; Kalra 2005;				
Home situation	7/19 studies				
stated in inclusion/exclusion criteria	Benaiges 2014; Garasen 2007; Mendoza 2009; Ricauda 2008; Rodriguez-Cerillo 2009, 2013; Lau 2013				
Individual coping abilities	2/19 studies				
stated in inclusion/exclusion criteria	Patel 2008; Rodriguez-Cerillo 2013				

## Page 45 of 70 Appendix 5: Detail of included studies

 **BMJ Open** 

#### Paramedic/ECP) interventions (n=3)

Author Year	Study	Participants	Intervention	Control	Outcomes assessed	Results
Country						
Mason	Cluster RCT by service	Inclusion criteria:	A paramedic practitioner	A paramedic	Relevant measures &	Intervention vs. control
		Patients aged ≥60yrs recruited	based in the ambulance	practitioner based in	outcomes	
2007	56 clusters	from 1 Sep 2003- 26 Sep 2004.	control room identified	the ambulance control		Primary outcomes
		Call originated from a Sheffield	eligible calls by the	room identified eligible	Primary outcomes	ED attendance (28 days)
UK	Intervention:	postcode between 8am-8pm, with	presenting complaint and	calls by the presenting	50	970 (62.6%) vs. 1286 (87.5%
	paramedic practitioner	a presenting complaint that fell	notified a paramedic	complaint and notified	ED attendance	p<0.001
	service	within the scope of practice of the	practitioner. All identified	a paramedic	Hospital admissions within	Hospital admissions (28 day
	n=1469	paramedic practitioners.	patients were approached	practitioner in the ED	28 days Time of call to time of	Hospital admissions (28 day 626 (40.4%) vs. 683 (46.5%)
	Control	Evolution exiterio	face to face either in the	In the ED		
	Control:	Exclusion criteria:	community or in ED for	Procedure continued	discharge	p<0.001
	Inactive paramedic	None given	written consent to follow- up. Patients who had more	as for intervention	Patient satisfaction survey	Magn Time of anll (CD) to ti
	practitioner service n=1549	'If patients were unable to	than one eligible episode	as for intervention	including the EQ-5D	Mean Time of call (SD) to the of discharge in mins
	11-1349	complete questionnaires e.g.	were recruited only once.		Secondary outcomes	235.1(183.3) vs. 277.8(182.6
		because of cognitive impairment	The research team		Secondary outcomes	p<0.001
		or who were unable to read	independently checked the			h-0.001
		English—we obtained consent for	ambulance service call		Subsequent unplanned	Patient satisfaction survey
		follow-up by review of clinical	database at the end of each		contact with secondary	including the EQ-5D
		records only.	month for any additional		care at 28 days	Very satisfied with care 656
		records only.	eligible calls not identified		cure ut 20 uuys	(85.5%)vs.528 (73.8%)
		Baseline characteristics of	These were checked for		Mortality at 28 days	p<0.001
		participants	selection bias but not		Montanty at 20 days	p<0.001
		Intervention vs. control	followed up. Scope of			Secondary outcomes
		Mean age (SD)	practice of paramedic			
		82.6(8.3) vs. 82.5(8.3) yrs	practitioners: Falls,			Subsequent unplanned
		Women %	Lacerations, Epistaxis, Minor			contact with secondary care
		72 vs.73%	burns, Foreign body in ear,			330(21.3%) vs. 259 (17.6%)
		Living in on own home %	nose, or throat, Local			p<0.01
		78vs.78 %	anaesthetic techniques,			•
		Presenting complaint %	Wound care and suturing			Mortality at 28days
		Fall 88 vs.89%	techniques, Principles of			68(4.4%) vs.74(5%) p=0.41
		Haemorrhage 6 vs.5%	dressings and splintage,			
		Acute medical condition	Joint examination,			
		6vs.5%	Examination of neurological,			
			cardiovascular, and			
			respiratory system,		ie <sub>h</sub>	
			Examination of ear, nose,			Phy.
			and throat, Protocol led			
			dispensing: simple			
			analgesia, antibiotics,			
			tetanus toxoid, Assessment			
			of mobility and social needs,			
			Additional options for			
			referral and requesting			
			investigations, Requests for			
			radiography, Referral			
			processes: emergency			
			department, general			
			practitioner, district nurse,			
			community social services		1	

-							
	Author Year	Study	Participants	Intervention	Control DIVIJ Ope	N <sub>Outcomes</sub> assessed	Results
	Country						
	Gray	COS with historical	The study included two groups of	Outline of intervention	Outline of control	Relevant measures &	ECP vs. ED
1		controls	patients a) those with breathing		Comparison data taken	outcomes	
2	2008		difficulties & b) elderly patients	Jan-April 2006 inclusive, all	Jan- April 2005		Outcome on initial contact:
3		Intervention:	>65yrs with a fall. The latter only is	the patients seen by the ECP	inclusive for	Outcome on initial contact:	Stayed at home (PC
5	UK	Emergency care	reported here.	service who had rung 999	attendances to same		referral)/went home
4		practitioner (ECP)		and were an elderly patient	ED for patients with	Treated at and stayed	171 vs. 369
5		intervention	Inclusion criteria:	(>65yrs) with a fall were	the same criteria as	home	(73% vs. 48% avoidable
6		n=233	Elderly patients >65yrs with a fall.	reviewed. Each patient seen	above & seen by		admission rate)
0			Exclusion criteria:	by an ECP was searched	non-ECP ambulance	ED and or admitted	
7		Control:	None given	for in the hospital records	service personnel.		At 72hr:
8		Historical control group	-	for ED attendance or	These dates were	At 72hrs & 28 days	21/171 (intervention grp)
-		from ED	Baseline characteristics of	admissions in 72 h and 28	chosen because, during	At home	attended ED and or were
9		n=772	participants	days following	this time, the ECP	ED attendance	admitted
10				attendance by an ECP	service was not tasked	Admission	
11			None given		to patients with		At 28 days:
					breathing difficulties		A further 19 (intervention grp)
12					and Yorkshire	Costs	attended ED and or were
13					Ambulance Service had	None	admitted
14					only 12 operational		
					ECPs during this		Avoidable admission rate
15					comparison period		(intervention grp) at 28 days
16					compared with 24		was 56% ( 17% better)
17					whole-time equivalent		compared to control group
					operational ECPs		p<0.05
18					during the		
19					study period		
		1					1
20							

Der					DMLO		
Paç	e 47. nof 70	Study	Participants	Intervention	Control BIVIJ Ope	Outcomes assessed	Results
	Year						
	Country	COS	Inclusion criteria:	Outline of intervention	Outline of control	Delevent measures 9	Discharged with no further
1	Mason	cos	Inclusion criteria: Informed consent was obtained	Outline of intervention	Outline of control	Relevant measures & outcomes	Discharged with no further follow up by any health
2	2012	Intervention:	from all study participants prior to	No detail	No detail	outcomes	professional
	2012	Five teams of Emergency	recruitment. Within each pair of	No detail	No de tall	Using paired services	49.2 vs.12.4%
3	UK	Care Practitioners (ECP)	services all patients presenting				MD 36.8% (95% CI 26.7,46.8)
4	•	n= 256 for care home	with emergency or urgent			Primary outcomes	
5		cohort	complaints that were eligible to be				Urgently referred to hospital
6		Control:	seen by ECPs and presented to			% of patients	(both ED or direct admission)
		Five usual care providers	either the intervention or the			Discharged following	22.7 vs. 87.6%
7		n=201 for care home	control services between May			consultation with no	MD -64.9% (95% CI
8		cohort	2006 and August 2007 were			further follow up by any	-71.8 ,58.0)
9			included in the trial.			health professional	
10			Exclusion criteria: No detail			Urgently referred to	Non-urgently referred to GP
			No detail			hospital (both ED or direct	or community care
11			Baseline characteristics of			admission)	28.1vs. 0%
12			participants			,	28.1% (22.6,33.7)
13			(no stats given)			Non-urgently referred to GP	
14			Care home cohort			or community care	Episode time from first
			Intervention vs. control				contact to discharge
15			Mean age			Secondary outcomes	median in mins (IQR)
16			83.5(10.40 vs. 84.5(8.5) yrs			(relevant ones only)	60 (40,80) vs. 39 (29,58)
17							Time ratio
18			% Female			Episode time from first	1.36 (1.24,1.49)
			68 vs.66%			contact to discharge	
19			Clinical complaint %				
20			Adult medical 30 vs.41 %				
21			Adult trauma 46 vs.13 %				
22			Elderly falls 23vs.46%				
23							
24							
25							
26							
27							
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31							
32							
<u>32</u>							
33							

#### ED Interventions (n=3)

#### **BMJ Open**

uthor Study	Participants	Intervention	Control	Outcomes assessed	Results
/ear					
untry					
Sun RCT	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	Observation vs. s care
	Patients aged≥ 50 years or older	Patients received	The syncope protocol was	outcomes	Inpatient
014 Intervention:	diagnosed with intermediate	continuous cardiac	not used. Contamination		admission rates
ED observation syncope	syncope.	monitoring $\geq$ 12hrs. $\leq$ 2	between groups was	Primary outcomes	9 (15%) vs. 57 (92%)
JSA protocol		serial cardiac troponin	minimized by being	Inpatient admission rates	Relative rate 0.16 (95%CI
n=62	Exclusion criteria	tests approx. 6 hours	managed in distinct	Hospital LOS at indexed	0.09,0.29, p<0.001)
	Patients with a serious condition:	apart to exclude acute	physical spaces by	visit	Hospital LOS at indexed visit
Control:	symptomatic arrhythmias,	MI. Rest echocardiogram	different clinical services.		mean SD (hrs) 29 (15) vs.
Normal In-patient	myocardial infarction, pulmonary	for patients with cardiac		Secondary outcomes	47hrs (34) (p<0.001)
admission	embolism, acute pulmonary	murmur, if not performed	Intervention delivered	30 day and 6mth serious	Serious events
n=62	edema, stroke, severe anaemia or	in previous 6mths.	by:	events	During hospital visit
	blood loss requiring blood	Additional testing as	No detail		Death 0 vs. 0
	transfusion, sepsis, and major	required. Maximum stay		Index and 30 day hospital	Arrhythmia 2 vs. 2
	traumatic injury.	in observation unit could		costs	Pacemaker insertion
	Also: seizure, head trauma, or	not be more than 24hrs.		30 days changes in QoL	1vs.1
	intoxication as reason for loss of	Observation protocol		30 day patient satisfaction	Syncope with bone fracture
	consciousness; new/ baseline	patients who received a			2 vs.1
	cognitive impairment; do-not-	diagnosis detailed in			30 days recurrent syncope 1
	resuscitate or do-not-intubate	exclusion list or had			vs 1
	status; active chemotherapy and	pending tests at 24hrs			30 day serious outcomes after
	inability to speak either	were admitted			discharge 2 vs. 0
	English/Spanish. Met high risk	High Risk Criteria			6mth serious outcomes
	criteria.	Serious condition identified in the ED, History of ventricular			after hospital discharge
	Baseline characteristics of	arrhythmia, Cardiac device			4 vs.5
	participants	with dysfunction, Exertional			Costs \$ (SD)
	Observation vs. control	syncope, Presentation			At index visit
	Mean(SD) or%	concerning for acute coronary			1,400(1,220) vs.2,420(3,930)
	Mean age	syndrome, Severe cardiac			Within 30 days
	65 (11) vs. 64(11)	valve disease (e.g., aortic stenosis <1 cm2), Known			1,800(2,150) vs.2,520(3,980)
	% Female	cardiac ejection faction <40%			Change in quality of life mean
	53 vs. 48	Electrocardiogram findings of			SD
	Syncope index complaint (vs near	QTc>500 mS,pre-excitation,			0 (0.2) vs. 0.03 (0.18)
	syncope)	non-sustained ventricular			Change in syncope functional
	74vs. 61%	tachycardia, Emergency			status
	Congestive heart failure	physician judgment Intermediate Risk Criteria No			-7.6(20.1) vs2.4(26.3)
	2vs. 3%	high risk features AND			Patient satisfaction
	Coronary artery disease	No low risk features AND			8.9(1.40 vs.9.3(0.9)
	13vs.8%	Clinical judgment by			
	Arrhythmia 8vs.6%	emergency physician that			
	Syncope in previous yr	patient requires further			
	16vs.21%	diagnostic evaluation Low Risk Symptoms			
	Quality of well-being scale	consistent with orthostatic or			
	0.55(0.15) vs. 0.55(0.14)	vasovagal syncope,			
	Syncope functional status	Emergency physician			
	29((25) vs.25(26)	judgment that no further			
	Syncope risk score	diagnostic evaluation is			
	0.76 (0.840 vs.0.76 (0.67)	needed.			
		Syncope functional status 29((25) vs.25(26) Syncope risk score	0.55(0.15) vs. 0.55(0.14)     vasovagal syncope,       Syncope functional status     Emergency physician       29((25) vs. 25(26)     judgment that no further       Syncope risk score     diagnostic evaluation is	0.55(0.15) vs. 0.55(0.14)vasovagal syncope,Syncope functional statusEmergency physician29((25) vs. 25(26)judgment that no furtherSyncope risk scorediagnostic evaluation is	0.55(0.15) vs. 0.55(0.14)     vasovagal syncope,       Syncope functional status     Emergency physician       29((25) vs.25(26)     judgment that no further       Syncope risk score     diagnostic evaluation is

Pa <del>ge 4</del> ₿	and 70	Study	Participants	Intervention	Control BMJ Ope	Outcomes assessed	Results
	/ear untry						
	naiges	COS	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	Mean (SD)
				Patients assigned to DH if	At hospital discharge, CH	outcomes	DH vs.CH
2	014	Intervention:	Patients with sustained	admitted to hospital	patients were scheduled	(no distinguishing between	Readmissions for diabetes (%)
3		'Day hospital' (DH)	hyperglycemia (>300 mg/dL) for at	within DH opening hours	for a one-week follow-up	primary and secondary	1(1.6)vs. 5 (13.9)
Sr	pain	n=64	least 3 days with or without	(week days 8 am -4 pm);	visit in outpatient clinic.	outcomes )	P=0.04
			ketosis	otherwise they were			Readmission for any cause (%)
5		Control:		treated in ED and	Intervention delivered	At 3 mth follow up	4(6.3)vs.7(19.4) p=0.085
5		Conventional	Fucharian anitania	subsequently	by:	This of wild an annual	No. of outpatient visits (SE?)
,		hospitalisation (CH) n=36	Exclusion criteria Ketoacidosis (venous pH <7.31	hospitalized. After initial treatment of	Unclear but normal outpatient staff	[No. of mild or severe hypoglycemic episodes ]	5.0(2.2)vs. 2.5(2.0) p=0.012
		11-50	and/or HCO3 <22 mEq),	hyperglycemic crisis DH	outpatient stan	hypogryceniic episodes j	No. of ER visits (SE?)?
3			hyperosmolar crisis (glycemia >600	patients were scheduled		Readmissions for diabetes	0.2(0.6)vs.0.2(0.4)
)			mg/dL and effective plasma	for follow-up visits at 24,		or unrelated cause	P=0.59
0			osmolarity >320 mOsm/L),	72 hours, and 7 days to			Costs
1			unstable hemodynamic status or	adjust treatment and to		[Nosocomial complications	Initial care
2			need for ventilatory support,	complete their diabetes		1	580.2(489.1) vs.
			severe precipitating factors such as	education			2,013.6(790.4) p<0.001
3			acute myocardial infarction,			No. of outpatient visits	Complementary examinations
4			stroke, sepsis, social deprivation,	Patients were treated			123.7(276.3) vs. 281.3(188.1)
5			and dependence for four or more	with same protocol for		No. of ER visits	p=0.007
			activities of daily living (Katz index	both DH and CH: this			Pharmacy
6			>D).	included initial evaluation with a blood test,		[outcomes] not detailed as not relevant to our question	12.8(95.6)vs. 20.3(24.8) P=0.676
7				urinalysis, chest		not relevant to our question	Outpatient visits
8			Baseline characteristics of	radiograph to rule out			116.7(75.3) vs. 56.9(105.7)
9			participants	underlying infectious		Costs	p=0.003
			(Stats shown if signif)	disease, and hourly			Readmissions (total)
20			DH vs.CH	measurement of glycemia		Initial care	340.8(1190)vs.288.3(916.8)p=
21			Age	and ketonemia.		Complementary	0.835
2			80.3(4.8)vs. 80.6(4.6)yrs	Treatment included		examinations	Total
23			Female	hydration as required, an		Pharmacy	1,345.1(793.6) vs.
24			67 vs. 56% <b>BMI</b>	insulin regimen with insulin, and oral		Outpatient visits Readmissions	2,212.4(982.5) p<0.001
			26.1(4.9)vs.25.5(5.1)	carbohydrate intake if		Total	
25			Katz A&B	glucose levels were less		Total	
26			72.2vs.72.2%	than 250 mg/dL with		In euros	
27			Charlson Index	persistent ketosis. If			
28			3.2(2.0)vs. 3.3(1.7)	infection was diagnosed,			
			Family support	treatment was initiated.			
29			88.1 vs.97.1%	Diabetes education was			
80			Diabetes duration	delivered by specialist			Dry
31			14.4 (8.0) vs. 97.1 yrs	diabetes nurse with			
2			Plus other specific diabetes	specific attention paid to			
			measures	dietary advice, physical activity, and recognition			
3				of hypoglycemia.			
34				Measurement of glycated			
5				hemoglobin (HbA1c) and			
6				clinical evaluation was			
				scheduled for 3 & 6 mths			
37				for patients in both			
8				groups			
9							

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Г	/				BM.I One	n <sub>Outcomes assessed</sub>	
	Author Year	Study	Participants	Intervention	Control BIVIJ Ope	Outcomes assessed	Results
	rear Country						
. 1	Salvi	COS	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	CED vs. GED
1		(secondary analysis)	Patients aged $\geq$ 65yrs were	No details beyond	Patients presenting to	outcomes	Mean duration (SD)
2	2008		enrolled in June 2006 from the	ED plus observation unit of	ED were screened		6.2(4.5) hrs vs. 12.8 (8.5) hrs
		Intervention:	GED and July 2006 from the CED	6 beds	Mon-Fri 9am- 6pm	Mean duration (SD)	P<0.001
3	Italy	Geriatric ED (GED)	taking care that none presenting		using standard		No. of initial admissions
4	•	n=100	to the ED in the course of the	Intervention delivered by:	information sheet.	No. of initial admissions	53 vs.63 p=0.2
5			study period was recruited again.	No details	Interviews conducted	-	LOS in days
		Control:			with patients or family	LOS in hospital days	10(6.65) vs. 10.5(7.2) p=0.74
6		Conventional ED (CED)	Exclusion criteria		member/other for		No. ED visits
7		n=100	Cognitive impairment		patients with cognitive	Both of above presented as	30 days
8			(a score of ≥5 on the Short		impairment. Written	baseline data	25 vs. 23 visits p=0.88
9			Portable Mental Status		consent & access to		6months
			Questionnaire SPMSQ )		medical records was	No. ED visits at 30 days and	51 vs. 42 p=0.25
10			and no proxy,		obtained. patients a	6 mths	Frequent ED return (≥3 visits
11			Those too ill to respond, Trauma		underwent a brief		over 6 mths)
12			patients		geriatric assessment	Frequent ED return (≥3	11 vs.13 visits p=0.84
					using the Charlson	visits over 6 mths)	No. hospital admissions at
13			Baseline characteristics of		Index, SPMSQ, and		6mths
14			participants		ADL before the current	No. hospital admissions at	36 vs.29 p=0.2
15			CED vs GED		event	6mths	<b>ADL</b> 20 vs. 20 p=0.34
			Mean(SD)			ADL at 6mths (defined as	Mortality 30 days 8 vs. 5 deaths
16			Age 78.1(7) vs.82.5(7.20 p<0.001 Female 47 vs. 68% p<0.001			functional decline	6 6 6 7 6 7 6 7 7 7 7 7 7 7 7 7 7 7 7 7
17			Married 70 vs. 40% p<0.001			junctional decine	Statistically significant at
18			Living alone 12 vs 14			Mortality at 30 days & 6	6mths after adjustment for
			Triage code			mths	age, sex, living status,
19			Urgent/semi-urgent (2/3)			intens	admission at time of
20			97 vs.90 %				recruitment Charlson index,
21			Charlson Index 3.3(2.3) vs. 3.4(1.7)			Costs	SPMSQ and ADL
22			SPMSQ			None	p=0.047
			2.5(3.3) vs. 5.2(4.2) p<0.001				
23			ADL4.3(2) vs. 3.2(2.5)				
24			P=0.001				
25							
			No differences in profile of				
26			diagnosis in ED between groups				
27							
28							
29							
30							
31							
32							
33							
34							

## Page 51 of 70 Community hospital (n=2)

Author	Study	Participants	Intervention	Control	Outcomes assessed	Results
Year						
Country						
Garåsen	RCT	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	CH vs. GH No. (%)
		Patients aged ≥60 years admitted	On admission to CH the	The care at different	outcomes	At 26 weeks
2007/8ab	Intervention:	to general hospital due to acute	physicians	departments at GH and		No. of readmission for ind
	Community hospital (CH)	illness or acute exacerbation of	performed a medical	communication with	Follow up at 26 weeks & 12	disease
	n=72 assigned but 8 went	known chronic disease	examination of the patients	primary health care	months	14(19%) vs. 25 (36%) p=0.0
Norway	on to GH		and a	followed the standard		Need for community home
		Probably in need of in ward care	careful evaluation of	routines through the	No. of readmission for	care
	Control:	for ≥ 3-4 days	available earlier health	formal organisation.	index disease	38(53%) vs. 44(63%) p=0.3
	General hospital		records from			Need for long term nursing
	(GH)admission	Admitted from own homes and	the admitting general		Need for community home	home
	n=70	expected to return home when	practitioner, the general		care	7(10%) vs. 5(7%)
		care finished.	hospital physicians and the			p= 0.76
			community home care		Need for long term nursing	No. days in institutions
		Exclusion criteria	services. The		home	31(95% CI 26.1,34.7) vs.29
		Severe dementia or a psychiatric	communication with each			(95% CI 23.2,36.4) p=0.80
		disorders needing specialised care	patient and his family		No. of days in institutions	No. of deaths
		24 hours a day.	focusing on physical and		after randomisation	9(12.5%) vs14(20%) p=0.15
			mental challenges was also		[intervention +rehab	No. days before death
		Baseline characteristics of	essential to understand the		+readmissions] data is	165 (95% CI 154-176) vs. 1
		participants	needs and level of care.		available for separate	(95% CI 144,165)
		(No stats given)			services	No care
		[including data from	Assume from the inclusion			18(25%) vs. 7(10%) p=0.02
		n=8 who were assigned CH then	criteria that all patients		No. of deaths	12 month data
		went to GH]	came to the general hospital			No. of deaths
			initially then		No. of days before death	13(18.1%) vs. 22 (31.4%)
		CH vs.GH				p=0.03
		Age	' When an eligible patient		No care	Total observation period
		80.6 (0.8)vs. 81.3(0.8)yrs	was identified and accepted			335.7(95% CI 312.0,359.4)
		Female	for inclusion, a blinded		12 month data in [0273]	292.8(95%CI 264.1,321.5)
		72 vs.61%	randomisation was			days p=0.01
		Living with spouse	performed by the			
		16 vs. 15	Clinical Research		Costs	
		ADL (SD)	Department at the Faculty		None	
		2.24(0.9) vs. 2.05 (0.7)	of Medicine.'			
		Primary diagnosis			· · · · · · · · · · · · · · · · · · ·	
		Cardio dis 31 vs.29%	All patients randomised for			
		Infect 18vs. 23%	care at the community			
		Fractures/contusions	hospital were transferred			
		19vs. 17%	from the general			
		Pulmonary disease	hospital within 24 hours			
		7vs.9%	after the time of inclusion to			Dry
		Neurological 7 vs.6%	the study and immediately			
		Cancer 3 vs 6%	after the time of			
		Psychiatric 1vs.0%	randomisation.			
		<b>Other</b> 14 vs 11%				
	1					

Goi Sweden bas n=4 Cor Goi	CT ttervention: ioing to a community- ased hospital =410 iontrol: ioing to ED =396	Inclusion criteria: No specific information Exclusion criteria: No specific information older adults were randomized when they called the emergency number Baseline characteristics of participants Intervention vs. control Mean age (SD) 81 (8) vs. 81(8) yrs % Female 56 vs. 59% Priority level when ambulance sent out (% individuals)	Outline of intervention The study was conducted over 14 months from Oct 2008 to Dec 2009. Two EMS companies were included in the study. Ambulance personnel at Company 1 had training in and access to the system and tool and could triage eligible individuals to a GW or, a CECC at a CH. By following system and tool & after assessment of the individual's medical situation and care needs, the ambulance nurse was able to decide whether the individual required full ED	Outline of control Ambulance personnel at Company 2 had no training in the system and tool, and transported all individuals to a full- service ED at a tertiary hospital	Outcomes assessed         Relevant measures & outcomes         Primary outcome:         No. of individuals sent direct to CH for either to GW or CECC         Secondary outcome:         No. of subsequent transfers from CH to ED within 24 hrs         Calculated as Intention to treat (ITT) and per protocol (pp) analysis         Costs         None	Intervention vs. control No. of individuals sent direct to CH for either to GW or CECC ITT 90/449 20% (16.6,24) PP 56/273 20.5% (16.1,25.7) No. of subsequent transfers from CH to ED within 24 hrs ITT 6/90 6.7% (3.1,13.8) PP 4/56 7.1 (2.8,17.0)
Vicente RCT 2014 Inte Goi Sweden bas n=4 Cor Goi	tervention: toing to a community- ased hospital =410 ontrol: toing to ED	No specific information Exclusion criteria: No specific information older adults were randomized when they called the emergency number Baseline characteristics of participants Intervention vs. control Mean age (SD) 81 (8) vs. 81(8) yrs % Female 56 vs. 59% Priority level when ambulance	The study was conducted over 14 months from Oct 2008 to Dec 2009. Two EMS companies were included in the study. Ambulance personnel at Company 1 had training in and access to the system and tool and could triage eligible individuals to a GW or, a CECC at a CH. By following system and tool & after assessment of the individual's medical situation and care needs, the ambulance nurse was able to decide whether the	Ambulance personnel at Company 2 had no training in the system and tool, and transported all individuals to a full- service ED at a tertiary	outcomes Primary outcome: No. of individuals sent direct to CH for either to GW or CECC Secondary outcome: No. of subsequent transfers from CH to ED within 24 hrs Calculated as Intention to treat ( ITT) and per protocol (pp) analysis Costs	No. of individuals sent direct to CH for either to GW or CECC ITT 90/449 20% (16.6,24) PP 56/273 20.5% (16.1,25.7) No. of subsequent transfers from CH to ED within 24 hrs ITT 6/90 6.7% (3.1,13.8)
2014 Inte Goi Sweden bas n=4 Cor Goi	tervention: toing to a community- ased hospital =410 ontrol: toing to ED	No specific information Exclusion criteria: No specific information older adults were randomized when they called the emergency number Baseline characteristics of participants Intervention vs. control Mean age (SD) 81 (8) vs. 81(8) yrs % Female 56 vs. 59% Priority level when ambulance	The study was conducted over 14 months from Oct 2008 to Dec 2009. Two EMS companies were included in the study. Ambulance personnel at Company 1 had training in and access to the system and tool and could triage eligible individuals to a GW or, a CECC at a CH. By following system and tool & after assessment of the individual's medical situation and care needs, the ambulance nurse was able to decide whether the	Ambulance personnel at Company 2 had no training in the system and tool, and transported all individuals to a full- service ED at a tertiary	outcomes Primary outcome: No. of individuals sent direct to CH for either to GW or CECC Secondary outcome: No. of subsequent transfers from CH to ED within 24 hrs Calculated as Intention to treat ( ITT) and per protocol (pp) analysis Costs	No. of individuals sent direct to CH for either to GW or CECC ITT 90/449 20% (16.6,24) PP 56/273 20.5% (16.1,25.7) No. of subsequent transfers from CH to ED within 24 hrs ITT 6/90 6.7% (3.1,13.8)
Sweden Goi n=4 Cor Goi	ioing to a community- ased hospital =410 iontrol: ioing to ED	Exclusion criteria: No specific information older adults were randomized when they called the emergency number Baseline characteristics of participants Intervention vs. control Mean age (SD) 81 (8) vs. 81(8) yrs % Female 56 vs. 59% Priority level when ambulance	over 14 months from Oct 2008 to Dec 2009. Two EMS companies were included in the study. Ambulance personnel at Company 1 had training in and access to the system and tool and could triage eligible individuals to a GW or, a CECC at a CH. By following system and tool & after assessment of the individual's medical situation and care needs, the ambulance nurse was able to decide whether the	at Company 2 had no training in the system and tool, and transported all individuals to a full- service ED at a tertiary	Primary outcome: No. of individuals sent direct to CH for either to GW or CECC Secondary outcome: No. of subsequent transfers from CH to ED within 24 hrs Calculated as Intention to treat ( ITT) and per protocol (pp) analysis Costs	to CH for either to GW or CECC ITT 90/449 20% (16.6,24) PP 56/273 20.5% (16.1,25.7) No. of subsequent transfers from CH to ED within 24 hrs ITT 6/90 6.7% (3.1,13.8)
Sweden bas n=4 Cor Goi	ased hospital =410 <b>ontrol:</b> ioing to ED	No specific information older adults were randomized when they called the emergency number Baseline characteristics of participants Intervention vs. control Mean age (SD) 81 (8) vs. 81(8) yrs % Female 56 vs. 59% Priority level when ambulance	2008 to Dec 2009. Two EMS companies were included in the study. Ambulance personnel at Company 1 had training in and access to the system and tool and could triage eligible individuals to a GW or, a CECC at a CH. By following system and tool & after assessment of the individual's medical situation and care needs, the ambulance nurse was able to decide whether the	at Company 2 had no training in the system and tool, and transported all individuals to a full- service ED at a tertiary	No. of individuals sent direct to CH for either to GW or CECC Secondary outcome: No. of subsequent transfers from CH to ED within 24 hrs Calculated as Intention to treat ( ITT) and per protocol (pp) analysis Costs	ITT 90/449 20% (16.6,24) PP 56/273 20.5% (16.1,25.7) No. of subsequent transfers from CH to ED within 24 hrs ITT 6/90 6.7% (3.1,13.8)
n=4 <b>Cor</b> Goi	=410 <b>ontrol:</b> joing to ED	older adults were randomized when they called the emergency number Baseline characteristics of participants Intervention vs. control Mean age (SD) 81 (8) vs. 81(8) yrs % Female 56 vs. 59% Priority level when ambulance	companies were included in the study. Ambulance personnel at Company 1 had training in and access to the system and tool and could triage eligible individuals to a GW or, a CECC at a CH. By following system and tool & after assessment of the individual's medical situation and care needs, the ambulance nurse was able to decide whether the	no training in the system and tool, and transported all individuals to a full- service ED at a tertiary	No. of individuals sent direct to CH for either to GW or CECC Secondary outcome: No. of subsequent transfers from CH to ED within 24 hrs Calculated as Intention to treat ( ITT) and per protocol (pp) analysis Costs	90/449 20% (16.6,24) PP 56/273 20.5% (16.1,25.7) No. of subsequent transfers from CH to ED within 24 hrs ITT 6/90 6.7% (3.1,13.8)
<b>Cor</b> Goi	ontrol: ioing to ED	when they called the emergency number Baseline characteristics of participants Intervention vs. control Mean age (SD) 81 (8) vs. 81(8) yrs % Female 56 vs. 59% Priority level when ambulance	the study. Ambulance personnel at Company 1 had training in and access to the system and tool and could triage eligible individuals to a GW or, a CECC at a CH. By following system and tool & after assessment of the individual's medical situation and care needs, the ambulance nurse was able to decide whether the	system and tool, and transported all individuals to a full- service ED at a tertiary	direct to CH for either to GW or CECC Secondary outcome: No. of subsequent transfers from CH to ED within 24 hrs Calculated as Intention to treat (ITT) and per protocol (pp) analysis Costs	PP 56/273 20.5% (16.1,25.7) No. of subsequent transfers from CH to ED within 24 hrs ITT 6/90 6.7% (3.1,13.8)
Goi	ioing to ED	when they called the emergency number Baseline characteristics of participants Intervention vs. control Mean age (SD) 81 (8) vs. 81(8) yrs % Female 56 vs. 59% Priority level when ambulance	personnel at Company 1 had training in and access to the system and tool and could triage eligible individuals to a GW or, a CECC at a CH. By following system and tool & after assessment of the individual's medical situation and care needs, the ambulance nurse was able to decide whether the	transported all individuals to a full- service ED at a tertiary	GW or CECC Secondary outcome: No. of subsequent transfers from CH to ED within 24 hrs Calculated as Intention to treat (ITT) and per protocol (pp) analysis Costs	56/273 20.5% (16.1,25.7) No. of subsequent transfers from CH to ED within 24 hrs ITT 6/90 6.7% (3.1,13.8)
		number Baseline characteristics of participants Intervention vs. control Mean age (SD) 81 (8) vs. 81(8) yrs % Female 56 vs. 59% Priority level when ambulance	had training in and access to the system and tool and could triage eligible individuals to a GW or, a CECC at a CH. By following system and tool & after assessment of the individual's medical situation and care needs, the ambulance nurse was able to decide whether the	individuals to a full- service ED at a tertiary	Secondary outcome: No. of subsequent transfers from CH to ED within 24 hrs Calculated as Intention to treat ( ITT) and per protocol (pp) analysis Costs	No. of subsequent transfers from CH to ED within 24 hrs ITT 6/90 6.7% (3.1,13.8)
n=3	=396	Baseline characteristics of participants Intervention vs. control Mean age (SD) 81 (8) vs. 81(8) yrs % Female 56 vs. 59% Priority level when ambulance	the system and tool and could triage eligible individuals to a GW or, a CECC at a CH. By following system and tool & after assessment of the individual's medical situation and care needs, the ambulance nurse was able to decide whether the	service ED at a tertiary	No. of subsequent transfers from CH to ED within 24 hrs Calculated as Intention to treat ( ITT) and per protocol (pp) analysis Costs	from CH to ED within 24 hrs ITT 6/90 6.7% (3.1,13.8)
		participants Intervention vs. control Mean age (SD) 81 (8) vs. 81(8) yrs % Female 56 vs. 59% Priority level when ambulance	could triage eligible individuals to a GW or, a CECC at a CH. By following system and tool & after assessment of the individual's medical situation and care needs, the ambulance nurse was able to decide whether the	,	No. of subsequent transfers from CH to ED within 24 hrs Calculated as Intention to treat ( ITT) and per protocol (pp) analysis Costs	ITT 6/90 6.7% (3.1,13.8)
		participants Intervention vs. control Mean age (SD) 81 (8) vs. 81(8) yrs % Female 56 vs. 59% Priority level when ambulance	individuals to a GW or, a CECC at a CH. By following system and tool & after assessment of the individual's medical situation and care needs, the ambulance nurse was able to decide whether the	hospital	from CH to ED within 24 hrs Calculated as Intention to treat ( ITT) and per protocol (pp) analysis Costs	
		Intervention vs. control Mean age (SD) 81 (8) vs. 81(8) yrs % Female 56 vs. 59% Priority level when ambulance	CECC at a CH. By following system and tool & after assessment of the individual's medical situation and care needs, the ambulance nurse was able to decide whether the		Calculated as Intention to treat ( ITT) and per protocol (pp) analysis Costs	PP 4/56 7.1 (2.8,17.0)
		Mean age (SD) 81 (8) vs. 81(8) yrs % Female 56 vs. 59% Priority level when ambulance	system and tool & after assessment of the individual's medical situation and care needs, the ambulance nurse was able to decide whether the		treat ( ITT) and per protocol (pp) analysis Costs	
		Mean age (SD) 81 (8) vs. 81(8) yrs % Female 56 vs. 59% Priority level when ambulance	system and tool & after assessment of the individual's medical situation and care needs, the ambulance nurse was able to decide whether the		treat ( ITT) and per protocol (pp) analysis Costs	
		81 (8) vs. 81(8) yrs % Female 56 vs. 59% Priority level when ambulance	individual's medical situation and care needs, the ambulance nurse was able to decide whether the		(pp) analysis Costs	
		% Female 56 vs. 59% Priority level when ambulance	situation and care needs, the ambulance nurse was able to decide whether the		Costs	
		56 vs. 59% Priority level when ambulance	the ambulance nurse was able to decide whether the		Costs	
		Priority level when ambulance	able to decide whether the			
					None	
		sent out (% individuals)	individual required full ED			
		1. 1.6 vs. 0%	services or would benefit			
		2. 59 vs. 47 %	more from being			
		3. 39 vs.53%	transported to an			
		P=0.001	assessment at the CH			
		Priority level when ambulance	instead.			
		arrives at hospital (% individuals)	Delivered by:			
		1. 7.2 vs.3.6%	The ambulance nurse			
		2. 39 vs.35%	education are required to			
		3.54 vs.61%	have a course of 60 credits			
			includes ≥ 30 credits in			
			Caring Science. The criterion			
			for entering this program is			
			a BSc Caring Science and			
			Nursing. Since 2007,			
			a 1-year Master's			
			Degree & postgraduate			
			Diploma in Specialist			
			Nursing, Prehospital			
			Emergency Care Program			
			has been available.			

#### Page 53 of 70 Hospital at home for community dwelling older people (n=9)

 BMJ Open

Author Year	Study	Participants	Intervention	Control	Outcomes assessed	Results
Country						
	pilot RCT Intervention: HC Treated at home after >48hrs treatment in ED (n=13) Control: CC Treated in hospital as per hospital treatment guidelines (n=18)	Inclusion criteria:Into studyEarlier diagnosed with CHF with diastolicor systolic LVDDeterioration of HF $\geq$ 3 days withsymptoms of increasing dyspnoea,orthopnoea, weight gian>2 kg, debutingperipheral oedema or abdominalswelling Clinical signs, e.g., extendedjugular vein, leg oedema, tachypnoea,pulmonary rales, ascites and third heartsound. At least one symptom and onesign should be presentNew York Heart Association class II-IVfor home treatmentIt was considered medically safe to treatpatients at home if they had a S-Potassium level 3.4-5.5 mmol/L, systolicblood pressure >95 mm Hg, SCreatinine<250 µmol/L & <50% increase	Outline of intervention Initially treated in the ED for ≥48 h & then sent home. The specialist HF nurses followed a written physician directed care plan including adjusting medications. A cardiologist could be consulted. All patients followed-up one day after returning home by nurse. The patients were visited daily or every other day for 5–7 days as appropriate. The home visits stopped when: (1) was symptomatically stable or improving, (2) had stable or falling weight, (3) had no signs of pulmonary rales and (4) had no oedema above the ankle. Patients could contact nurse by phone in office hours. Nurses at intensive cardiac care unit could be reached by telephone after office hours. A cardiologist was always available for phone consultation ≤1 month after the last home visit, the nurse was available for phone counselling.	Outline of control Treated in hospital as per hospital treatment guidelines	Relevant measures & outcomes         No distinction between primary and secondary outcomes         Clinical status was documented at 1,4,8& 12 mths         Direct costs for control group based on compensation paid to hospital and for home care group based on time & activities of nurses & physicians plus lab tests and i.v diuretic episodes         Readmissions from hospital data ( presumably up to 12mths – not listed in methods)	There was no significant difference in clinical events including readmissions adverse events or in HRQL (measured at baseline too). The total cost related to CHF was lower in the HC group after 12 months (p=0.05) detail of costs Euros HC vs. CC Nurse cost 386 (244-1107) v N/A Physician 35(19-74) vs. N/A Transport 96953-127) vs. N/ Total cost for care 586 (334-1125) vs. 3277 (2125-5750) Readmissions 0.5(0.8) vs. 0.6 (0.8) ns

Author Year Country	Study	Participants	Intervention	<sub>Control</sub> Bivij Ope	N <sub>Outcomes</sub> assessed	Results
Mendoza	RCT	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	Clinical outcomes were similar
2009		Patient of 65 years and over			outcomes	after initial admission and also
Garcia-	Intervention:	With diagnosis and prognosis	Characteristics of the HaH	Patients were admitted	outcomes	after the 12 months of follow-
Soleto	Hospital at home (HAH)	evaluation of HF since at least 12	unit explained whilst still in	to hospital, cardiology	No distinction between	up.
2013	care (n=37)	months prior to the study	ED. Given information sheet	ward & were managed	primary and secondary	up.
2013	Control:	NYHA functional class II or III	with contact phone	by the usual staff of	outcomes	
Spain	Inpatient hospital care	before coming to ED due to	numbers. Within 12–24 h of	cardiology specialists	outcomes	Death or re-admission due to
Span	(IHC) in a cardiology unit	exacerbation	the ED visit, patients	and nurses, in	Effectiveness	HF or a cardiovascular event
	(n=34)	Exclusion criteria	received scheduled & if	accordance with	Necessity to transfer the	occurred in 19 patients in IHC
Heart Failure	(11-3-4)	Admitted in the preceding 2	necessary, urgent visits to	guidelines.	patient from HaH to IHC	and 20 in HaH (P=0.88).
incare randice		months for deterioration of HF or	their homes from an	guidennes.	during the first admission	and 20 m nam (1 =0.00).
		acute coronary syndrome	internal medicine specialist		Mortality due to any cause,	Changes in functional status
		Presence of severe symptoms such	& a nurse, (staff of the HaH		re-admission due to HF, or	and health-related quality of
		as sudden worsening of HF	unit). If deterioration		another cardiovascular	life over the follow-up period
		Poor prognosis factors	occurred outside the		event (stroke, acute	were not significantly
		(haemodynamic instability, severe	working hours (8am-9 pm		coronary syndrome, and	different.
		arrhythmia, baseline creatinine	every day of yr), patients &		coronary revascularization)	uncrent.
		above 2.5 mg/dL)	family were instructed to		during 1 year of follow-up.	Average cost
		No response to treatment in the	call 112 to explain they		Functional status -Barthel	of initial admission
		ED	were HaH patients.		index	4502±2153E in IHC and
		Active cancer, severe dementia, or	Samples were taken for lab		Health-related quality of life	2541±1334E in HaH (P< 0.001)
		any other disease at an advanced	tests and ECGs were		-SF-36 since first admission	2541±1554E III Hall (F< 0.001)
		stage indicating life expectancy of	performed in patient's		up to 12 months later	During 12 months of
		less than 6 months	home		up to 12 months later	follow-up, the average
		Acute psychiatric diseases, active	nome			expenditure was 4619+7679E
		alcoholism	X-ray & echocardiography at		Costs	and 3425+4948E (P= 0.83)
		Active pulmonary tuberculosis	hospital was as		Cost of the stay	respectively.
		Those living in a psycho-geriatric	accessible for HaH patients		Medication, diagnostic tests	respectively.
		institution	as for in-patients. Generally		(electrocardiography,	
		No guarantee of all-day	all patients were visited		echocardiography,	
		supervision	daily by a specialist nurse.		laboratory tests, and chest	
		Absence of a telephone at home or				
		living more than 10 km from the	Patients were visited by a physician daily or every		X-ray), consumables, and transport.	
		hospital	other day depending on		visits to HF clinic, primary	
		Baseline characteristics of	condition. Treatment in HaH		care physician or ED, as well	
		participants IHC vs. HaH	finished with referral to		as re-admissions.	
		Women, n (%) 10 (29.4) 19 (51.4) 0.06 Age, mean +SD 79.9+6.3	primary care after recovery or, in case of		For re-hospitalizations, the cost of the admission was	
		78.1+6.2 0.20 Admissions for HF in	deterioration or no		estimated as the average	
		previous year 0.41+0.86 0.65+0.86	response to treatment, with		cost per day incurred during	
		0.13 O2 saturation in ED 91.4+5.2	transfer to the cardiology		the first admission for each	
		93.2+4.6 0.12 Functional Class	ward.		group.	
		NYHA II, n (%) 23 (67.6) 19 (51.4)	waru.		group.	
		Functional Class NYHA				
		III, n (%) 11 (32.4) 18 (48.6) 0.16				
		Atrial fibrillation, n (%) 16 (47) 21				
		(56.8) 0.49 LVEF ≥45%, n (%) 24				
		(50.8) 0.49 LVEF 245%, ft (%) 24 (70) 23 (62.1) LVEF , <45%, n (%)				
		10 (29.4) 14 (37.8) 0.13 NT-proBNP				
		(pg/mL) 4056+5352 3864+3720				
		0.86 Charlson index 2.1+1.3				
	1	2.5+1.5 0.35	1			1

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Year						
Country						
Tibaldi 2009	single blind RCT	Inclusion criteria: ≥75 years with a pre-existing	Outline of intervention The team has 7 cars, is	Outline of control The inpatient control	Relevant measures & outcomes	Primary outcomes Patient mortality at 6 months
Italy	Intervention:	diagnosis of CHF (stage C AHA) &	multidisciplinary and	group (GMW) received	outcomes	was 15% in the total sample,
itary	Physician led - Geriatric	persistent functional impairment	consists: 4 geriatricians, 13	routine hospital	Primary outcome	without significant difference
Heart Failure	Home Hospitalization	indicative of NYHA class III or IV	nurses, 3 physio-therapists,	care. Protocols for	Mortality at 6 months.	between the 2 settings of car
	Service (GHHS; n=48)	status presenting at hospital ED	1 social worker &1	prevention of	Secondary outcomes	( 7 vs. 8 deaths )
		for acute decompensation	counselor working together	nosocomial infections,	morbidity (infections,	Secondary outcomes
	Control:	(defined )& in need of hospital	as a team, with daily	bed	delirium, bed sores,	The number of subsequent
	Patients were randomly	care. Additional inclusion criteria	meetings	sores, and	deep vein thrombosis, and	hospital admissions
	assigned to the general	were appropriate care supervision	7 days a week. In ED all	immobilization are	falls) during hospitalization,	was not statistically differen
	medical ward (GMW;	at home, telephone connection,	necessary diagnostic	routinely adopted for	admissions to a nursing	in the 2 groups
	n=53)	living in the hospital at-home	tests are provided and then	frail elderly	home, and subsequent	8 (17%) vs. 18 (34%)
		catchment area, informed consent,	the patient moves home by	inpatients.	hospital admissions	man (CD) time to first
		at least 1 previous admission for	ambulance, usually within a few hours. Medical		related to any cause	mean (SD) time to first additional admission was
		acute CHF, and need for intravenous drug infusion.	consultation with other			longer for the GHHS patients
		Exclusion criteria	hospital specialists			(84.3 [22.2] days vs
		New-onset heart failure; absence	is possible in the hospital or			69.8[36.2] days vs
		of family and social support; need	at the home of the patient.			0010[0012] 00/00/ 102/
		for mechanical ventilation,	Treatments included			Only the GHHS patients
		hemodialysis, or intensive	physician and nurse visits,			experienced improvements
		monitoring; severe dementia ;	standard blood tests, pulse			Depression (GDS) +1.48 (1.8
		terminal malignant neoplasm;	oximetry, spirometry,			vs. +0.12 (3.36) p=0.02)
		severe renal impairment; hepatic	electrocardiography,			nutritional status (MNA) -
		failure; serum hemoglobin level	echocardiography etc (as			0.86(1.12) vs0.27 (1.78)
		less than 9 g/dL; and planned	per hospital) Patients			p=0.05
		cardiac surgery(eg, valve	treated at home and family members obtained			Quality-of-life(NHP) +1.09
		replacement). Baseline characteristics of	adequate Education e.g.			(2.57 VS. +0.18 (1.94) p=0.04
		participants	early recognition of			
		Long list of demographic & clinical	symptoms. Protocols for			
		baseline – truncated	prevention of nosocomial			
		GHHS vs. GMV	infections, bed sores, and			
		Mean age 82.2 (5.2) vs. 80.1(4.9)	immobilization are routinely			
		p=0.04	adopted for frail elderly			
		Male (%) 22(46) vs. 30 (57)	inpatients. In the first days			
		Married (%) 22 (46) vs. 24 (45)	after admission to GHHS			
		Family support at home (%)	patient was visited at home			
		48(100) vs. 53(100)	on a daily basis by			
		Length of disease (yr) 5.4 (4.7) vs. 5.2 (4.7) plus clinical symptoms	physicians and nurses. In the following days this care			
		5.2 (4.7) plus clinical symptoms both cardiovascular & general	is tapered off as appropriate			
		including functional status	Consultation with			
		(Barthel index) depression (GDS)	cardiologists or other			
		MMSE, MNA, comorbidity	hospital specialists was			
		measured by CIRS 3.6 (1) vs. 3.4	possible. Physicians and			
		(2) All ns except age	nurses were available at all			
			times for urgent home			
			visits.			

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Author	Study	Participants	Intervention	Control Divis Ope	N <sub>Outcomes</sub> assessed	Results
Year						
Country						
Ricauda	Single blind RCT	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	Primary outcomes
		Patients ≥75 yrs with a diagnosis of	Intervention delivered by;	Intervention delivered	outcomes	GHHS vs. GMW
2008	Intervention:	acute exacerbation of COPD,	"a physician-led	by:	a	Hospital readmissions at6mths
	Geriatric home	defined on Anthonisen criteria as	substitutive hospital-at-	The inpatient control	Primary outcomes	42% vs 87%, P= 0.001
Italy	hospitalization service	an increase in breathlessness,	home model of care"	group received routine	Hospital readmission &	Cumulative mortality at 6 mths
	(GHHS, n=52)	sputum volume, or purulence for		hospital care	mortality rates at 6 months.	was 20.2% in the total sample,
COPD		at least 24 hours, admitted to the	Patients assigned to HaH			No significant differences
	Control:	ED & requiring hospitalization.	were immediately		Secondary outcomes	between grps.
	General medical ward	Additional inclusion criteria were	transferred home by		Depression status -Geriatric	
	(GMW, n=52)	appropriate care supervision in the	ambulance. At		Depression Scale, functional	Secondary outcomes
		home, telephone connection,	home, a multi-dimensional		status- Katz activities	Mean length of stay
		living in the HaH & informed	geriatric assessment was		of daily living	15.5 ±9.5 vs 11.0 ± 7.9 days, P=
		consent.	conducted & patients		& Lawton instrumental	0.010
	1	Exclusion criteria	received hospital-level		activities of daily	Only GHHS patients
	1	Absence of family and social	treatment& services, as		, living	experienced improvements in
	1	support; severe hypoxemia (partial	their condition dictated.		Cognitive status -Mini-	depression and QoL
	1	pressure of oxygen <50 mmHg);	(Physician and nursing visits,		Mental State Examination,	scores but ns between grps
	1	severe acidosis or alkalosis (pH	standard blood tests, pulse		Quality of life -the	There were no differences in
	1	<7.35 or >7.55); suspected	oximetry,		Nottingham Health	functional, cognitive,
		pulmonary embolism; suspected	electrocardiogram,		Profile	nutritional, or caregiver
		myocardial infarction; severe	spirometry, echocardiogram,		Nutritional status -Mini	burden outcomes.
		comorbid illness as defined by	echographs and Doppler		Nutritional Assessment,	Satisfaction at discharge was
		presence of need for hemodialysis,	ultrasonographs,oral &		Caregiver characteristics -	very good or excellent
		severe renal impairment	intravenous medication		Relatives' Stress Scale, &	for 94% vs. 88% (P=0.83)
		(glomerular filtration rate <20	administration, including		satisfaction using ad hoc	(On a cost per patient per day
		mL/min), cancer (except skin	antimicrobials & cytotoxic		questionnaire for	basis,
		cancer), hepatic failure, or severe	drugs, oxygen therapy,		Scale.	(\$101.4 ± 61.3 vs \$151.7 ±
		dementia (Mini-Mental State	blood products transfusion,		Costs of care were	96.4, P=0.002).
		Examination score <14).	central venous access,		compared for the acute	
		Baseline characteristics of	surgical treatment of		episode.	
		participants	pressure sores, physical			
		Intervention vs. control	therapy & occupational			
	1	Age, mean ±SD 80.1 ±3.2 79.2 ±	therapy			
	1	3.1p=0 .20 Male, n (%) 29 (56) 39	The HaH program			
		(75) p=0.06 Married, n (%) 27 (52)	emphasized			
		29 (56) .84 Family support n (%) 52	patient & caregiver			
		(100) 52 (100) p=0.89 Current	education about the			
		smoker, n (%)7(13)6(11) p=0.97Ex-	knowledge of the disease,			21
		smoker, n (%) 34 (65) 35 (67)	giving advice about smoking			
		p=0.95 FEV1, mean ±SD 0.92 ±0.4	cessation,			
		1.04 ± 0.5 p=0.18 % of predicted	nutrition, management of			
		FEV1 38, 47 Home oxygen use,	activities of daily living &			
		n(%)18 (35)12 (23) p=0.45 Arterial	energy conservation,			
		blood gas, mean ±SD pH 7.40 ±	understanding & use of			
	1	0.04 7.41 ± 0.03 .19 PP of O <sub>2</sub> 69 ±	drugs, health maintenance,			
		19 65 $\pm \pm 14$ .p= 0.23 PP of CO <sub>2</sub> 44 $\pm$	& early recognition of			
		12 46 ± 12 .47 ADL score, mean ±	triggers of exacerbation that			
	1	SD± 2.3 ± 2.2 1.9 ± 2.2 p=0.36 IADL	required medical			
	1	score, mean ± SD 7.1 ± 4.9 8.1 ±	intervention.			
		4.2 .27 GDS score, mean ± SD 16.1				
		± 6.1 17.2 ± 6.8 .45 Comorbidity				
	1	index 2.6 ± 1.5 3.0 ± 1.8 p=0.24	1			1

Pag	je <u>57. p</u> f 70	Study	Participants	Intervention	Control BMJ Ope	n <sub>Outcomes assessed</sub>	Results
	Year	Study				outcomes assessed	Results
	Country						
1	Rodriguez-	COS	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	All comparisons ns
2	Cerillo	Intervention:	For trial Non-massive pulmonary embolism	No detail	No detail	outcomes	Mean stay length HH vs. CH
3	2009	Home hospitalization (HH)	No contraindications	No detail	No detail	No distinction between	8.9 days (7–14 days), vs. 10.6
		(n=30)	for treatment with			Primary and secondary	days (6–20 days).
4	Spain		low MW heparin			outcomes	
5		Control: Conventional	Absence of moderate				All patients in study had a favourable clinical
6	non-massive Pulmonary	Hospitalization (CH)	<ul> <li>to severe renal failure</li> <li>Haemodynamic</li> </ul>			Major and minor bleeding Re-thrombosis,	course.
7	embolism	(n=31)	stability			Clinical course	course.
8		. ,	O2 saturation higher			Unexpected returns to	No major bleeding, re-
9			than 92% breathing			hospital	thrombosis, or death
10			room air			Need for hospital re-admission in the	occurred.
11			<ul> <li>No signs of heart failure</li> </ul>			following 3 months.	One patient on HH
			No arrhythmia				experienced an abdominal
12			No haemoptysis				wall haematoma in the area
13			For HH				of administration of the low
14			Agreement to				MW heparin.
15			admission to our HH unit				One patient
16			<ul> <li>A valid caregiver at</li> </ul>				admitted to hospital
17			home				experienced a haematoma in
18			Residence in our				the right arm related to blood sampling for
19			health area				laboratory tests.
20			<ul> <li>A condition amenable to home management</li> </ul>				,
			Exclusion criteria				No patient with HH had
21			massive PE, haemodynamic				infectious complications. Three patients admitted to
22			instability, oxygen saturation				hospital were diagnosed of
23			lower than 92% on room air, heart				urinary tract infection.
24			failure, haemoptysis, arrhythmia & contraindication for treatment		· · · · · ·		
25			with low MW heparin				No HH patients required
26			Baseline characteristics of	Dee			unexpected return to hospital during admission.
27			participants				during durinssion.
28			Age 66.8 (27–91) 66.7 (31–90) n.s Sex (males) 30% 54.8% n.s				During follow-up, two patients
29			Diagnosed neoplasm 13.3% 9.7%				required hospital admission,
30			n.s Associated DVT 40% 29% n.s				one in each group. The cause was not related to the
			Prior TED 0% 19.3% 0.05				thromboembolic disease.
31			Dementia 23.3% 6.4% n.s. Hypertension 30% 45.1% n.s.				
32			Ischaemic heart disease 6.6% 9.6%				
33			n.s. Thrombophilia 3.3% 0% n.s				
34			Recent surgery 3.3% 6.4% n.s				
35			Unilateral involvement 70% 61.3%				
36			n.s Bilateral involvement 30% 38.7% n.s Diagnosed by helical CT				
37			26.6% 38.7% n.s				
38							
39							
39 40							
40							

				Control BMJ Ope	n <sub>e</sub> .	
Author Year	Study	Participants	Intervention	Control Divid Ope	Outcomes assessed	Results
Country						
Carratala	Open RCT	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	Intervention vs. control
		All immunocompetent patients	Outpatients were given oral	Hospitalized patients	outcomes	
2005	Intervention: Outpatient care with oral	who were at least 18 years of age and had received a diagnosis of	levofloxacin (500 mg/d), and	received sequential intravenous and oral	Primary outcomes	Primary outcome
Spain	levofloxacin therapy or	community acquired	received detailed written	levofloxacin (500 m	% of patients with an overall	Successful outcome was
	hospitalization with	pneumonia in the emergency	information about their	and received detailed	successful outcome at the	achieved in 83.6 vs. 80.7%
	sequential intravenous	department (24 hrs per day, 7 days	pneumonia diagnosis and	written information	end of treatment, according	(absolute difference, 2.9 %
Pneumonia	and oral levofloxacin	per week)	their treatment plan, as well	about their pneumonia	to 7 predefined criteria:	points [95% Cl, ±7.1 to 12.9 %
	therapy. (n=110)	Community and an analysis	as emergency	diagnosis and their	cure of pneumonia (as	points]).
	Control:	Community acquired pneumonia was defined as the presence of a	contact telephone numbers for a nurse or investigator	treatment plan, as well as emergency	defined later), absence of adverse drug reactions,	% patients with adverse drug reactions (9.1% vs. 9.6%),
	Hospitalisation (n=114)	new infiltrate on chest radiography	physician.	contact telephone	absence of medical	Subsequent hospital
		plus at least 1 of the following:	Patients were visited at	numbers for a nurse or	complications during	admissions
		fever (temperature ≥38.0 °C) or	home by a nurse 48 hours	investigator physician	treatment, no need for	(6.3% vs. 7.0%),
		hypothermia (temperature <35.0	after emergency	g/d) Patients assigned	additional visits, no changes	Overall mortality (0.9% vs. 0%)
		°C), new cough with or without sputum production, pleuritic chest	department discharge. The visit included assessment of	to hospitalization were seen daily during their	in initial treatment with levofloxacin, <b>absence of</b>	Medical complications (0.9% vs. 2.6%),
		pain, dyspnea, or altered breath	vital signs and	hospital stay by	subsequent hospital	(0.5% 43. 2.0%),
		sounds on auscultation.	measurement of oxygen	attending physicians	admission in the 30	Secondary outcomes
		Exclusion criteria	saturation by pulse	and by at least 1 of the	days after randomization,	All ns
			oximetry. If	investigators. Criteria	and absence of death from	Quality of life
		Neutropenia, HIV infection,	the nurse thought that a patient's condition was not	for early switching from intravenous	any cause in the 30 days after randomization.	(9.1% vs. 9.6%) Satisfied with overall care
		transplantation, or splenectomy or	improving	to oral levofloxacin		(91.2% vs. 79.1%; absolute
		who were taking immunosuppressive	(worsening of baseline vital	were a respiratory rate	Secondary outcomes	difference, 12.1% [Cl, 1.8 to
		drugs	signs, oxygen saturation, or	of 24	Patients' quality of life &	22.5 % points]).
		-	both), one of the	breaths/min or less, a	satisfaction	
		Baseline characteristics of	investigators made an additional visit. The nurse	pulse rate of 100 beats/min or less, a		
		participants Male 69 (62.7) 66 (57.9)	was involved only in	temp of 37.8 °C or		
		Female 41 (37.3) 48 (42.1)	outcome assessment.	lower on 2 occasions at		
		Mean age $\pm$ SD, y 67.5 $\pm$ 11.8 64.9	Patients were seen at the	least 8 hours apart,		
		± 13.4	outpatient clinic at days 7 and 30 after pneumonia	and maintenance of adequate oral intake.		
		Alcohol consumption $\pm 80 \text{ g/d}$ , n	diagnosis.	Physicians		
		(%) 13 (12.4) 7 (6.4) Current tobacco smoking, n (%)‡		were advised to		
		21 (19.8) 24 (21.8)		discharge patients		
		Influenza vaccine in current		after their clinical		
		season, n (%)§ 44 (42.7) 49 (46.2)		condition stabilized, in accordance with		
		Pneumococcal vaccine in the		previously		
		previous 5 yrs, <i>n (%)</i> ± 15 (15.6) 13 (13.1)		recommended criteria.		
		Comorbid conditions, n (%) 71		Patients were seen at		
		(64.5) 78 (68.4)		the outpatient clinic at		
		Mean oxygen saturation ± SD, %		days 7 and 30 after pneumonia diagnosis.		2012
		94.5 ± 2.0 94.5 ± 1.8		prieditionia diagnosis.		
		Multilobar pneumonia, n (%) 8 (7.3) 9 (7.9)				
		(7.3) 9 (7.9) Risk class, <i>n (%)</i> II 55 (50.0) 63				
		(55.3) III 55 (50.0) 51 (44.7)				
		Mean PSI score $\pm$ SD 70.0 $\pm$ 11.6				
		66.9 ± 12.5				

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Pag	e 59.0f 70	Study	Participants	Intervention	Control BMJ Ope	n Outcomes assessed	Results
	Year						
	Country	RCT	Datiants ware included within 72	Qutling of intervention	Outling of control	Delevent measures 9	Mortality and
1	Kalra	KU	Patients were included within 72 hours of stroke onset. The	Outline of intervention ST Patients were managed on	Outline of control SU	Relevant measures & outcomes	Mortality and institutionalisation at 1yr were
2	2005	Intervention:	research team was notified by	general wards & under care of	Care was provided by a	outcomes	lower on SU vs.ST or DC
3		1)ST (n=152)	telephone or fax by GPs for	admitting physicians. All patients were seen by specialist team:	stroke physician	Primary outcomes	
4	UK	The stroke team involved	patients at home, and by accident	doctor (specialist registrar	supported by a	Death or	Significantly fewer patients on
	a	management on	and emergency (A&E) services for	grade), a nurse (grade G), a	multidisciplinary team	institutionalisation at 1	SU died compared with ST
5	Stroke	general wards with specialist team support.	suspected stroke patients presenting to the casualty	physiotherapist (senior I) and an occupational therapist (senior I)	with specialist experience	year.	The proportion of patients
6		The team undertook	department.	with expertise in stroke	in stroke management.	Dependence - modified	alive without severe
7		stroke assessments and	Inclusion criteria:	management. Patients were	There were clear	Rankin Scale (mRS),	disability at 1 year was also
8		advised ward-based	Patients with disabling stroke	assessed by the specialist team, which undertook a diagnostic	guidelines for acute		significantly higher on SU vs.
9		nursing and therapy staff	who could be supported at home	evaluation and assessment for	care, prevention of		ST or DC.
10		on acute care, secondary prevention and	with nursing, therapy and social services input on initial assessment	needs. Ward provided the day- to-day treatment, the team	complications, rehabilitation and	Secondary outcomes included	These differences were
11		rehabilitation aspects.	were included in the study.	advised on specialist aspects of	secondary prevention,	Orgogozo scale, BI and FAI	present at 3 &
		2) DC (n=153)	Exclusion criteria	stroke care. It reviewed progress	and a culture of joint	for disability, the	6 mths after stroke.
12		Domiciliary care provided	Patients with mild stroke,	and treatment of individual patients with ward team &	assessments, goal	mRS for handicap	
13		management at home	severe strokes, already admitted	helped in discharge planning and	setting, coordinated	Fund Oal and R. C.	Stroke survivors on SU showed
14		under the supervision of a GP and stroke specialist	to hospitals, and those with unusual or atypical neurological	setting up of post discharge services. The team provided	treatment and discharge planning.	EuroQol-quality of life of patients and their	greater improvement on basic activities of daily living
15		with support from	features who required specialised	counselling, education and	uischarge platining.	carers.	compared the other two grps.
16		specialist team and	assessments or investigation to	support to the family, identified	A coordinated		Achievement of higher levels
17		community services.	establish a diagnosis of stroke.	expectations and advised about realistic outcomes in the context	multidisciplinary		of function was not
18		Support was provided for	Patients who were	of previous morbidity and	approach was adopted		influenced by strategy of care.
		a maximum of 3 months. Control:	institutionalised or had severe disability (Rankin 4 or 5) before	present deficits. DC Patients were managed in	towards rehabilitation, with emphasis on early		QoL at 3mths was significantly
19		Usual care SU (n=152)	stroke	own home by a specialist team	mobilisation. All		better in SU & DC patients.
20		The stroke unit provided	Baseline characteristics of	consisting of a doctor (specialist	patients had an		
21		24-hour care provided by	participants SU vs. ST vs.HC	registrar), a nurse (G grade) & therapists (senior I grades), with	individualised		There was greater
22		a specialist	Median age (years) (IQR) 75 (72–	support from district nursing and	rehabilitation plan with		dissatisfaction with care with
23		multidisciplinary team based on clear	84) 77.3 (71–83) 77.7 (67–83) No. of females (%) 69 (46.6) 76	social services for nursing and personal care needs. Patients	clearly defined goals based on joint		ST vs. SU or DC.
24		guidelines for acute care,	(50.6) 68 (45.6) Living alone (%) 50	were under the joint care of the	assessments. Patient		Poor outcomewith DC and ST
25		prevention of	(33.7) 55 (36.6) 50 (33.5)	stroke physician and GP. Investigations, including CT	participation was		was associated with Barthel
26		complications,		scanning, were performed in	encouraged, with focus		Index <5, incontinence and
		rehabilitation and		outpatient s. Therapy was	on motivation and		with ST, age >75 years.
27		secondary prevention.		provided by members of the specialist stroke team. Each	providing an enriched environment.		The total costs of
28		prevention		patient had an individualised	entrionnenti		stroke per patient over
29				integrated care pathway outlining activities and the			12mths were £11,450 for SU,
30				objectives of treatment, which			£9527 for ST & £6840 for DC
31				was reviewed at weekly			The mean costs per day
32				multi-disciplinary meetings.			alive for the SU were significantly less than those
33							for the ST , but no different
34							from DC patients.
							Costs for DC were significantly
35							less than for those managed by the SU or ST.
36			1		<u> </u>		by the 50 of 51.
37							
38							
39							
40							

Author	Study	Participants	Intervention	Control BMJ Ope	N <sub>Outcomes</sub> assessed	Results
Year Country	,					
Rodriguez-	Prospective controlled	Inclusion criteria:	Outline of intervention	Outline of control	Relevant measures &	A small amount of free fluid
Cerrillo	study	≥70 years diagnosed with		Intervention delivered	outcomes	was present in 38% of patients
	-	uncomplicated diverticulitis (The	Intervention delivered by;	by:		treated with HaH and 42% of
2013	Intervention:	existence of abscess, fistula, bowel	All patients were given	All patients were given	No primary nor secondary	patients in hospital.
	Patients stayed 24 h in the	obstruction and peritonitis)	Ertapenem after diagnosis.	ertapenem after	outcomes were defined	All patients had a good clinical
Spain	Observation Ward within	Patients who were willing to be	Patients in HaH grp stayed	diagnosis &		evolution. None of the
	ED prior to discharge and	treated at home and had a	24 h in the observation	experienced traditional		patients treated with HaH
ncomplicate	treatment at home. (n=34)	caregiver 24 h a day were	ward within ED prior to	hospitalisation		needed be transferred to
d	Control:	transferred to HaH. The rest of the	discharge.			hospital.
iverticulitis	Traditional hospitalization	patients were admitted to	At home, nurses			Mean stay was 9 days in HaH
	(n=18)	conventional hospitalization.	administrated Ertapenem every day. The physician			vs. 10 days in Hospital. The cost of each patient with
		Exclusion criteria	conducted 2–3 home visits			diverticulitis treated at home
		Patients with complicated	per week, depending on the			was 1368 euros cheaper than
		diverticulitis, $\beta$ -lactam allergy or	patient's clinical course. On			the cost of a patient treated in
		who required admission to	admission patients were			the hospital (fewer staff and
		hospital for other pathology	provided with a phone			important reduction of
			number to contact the unit			maintenance costs).
		Baseline characteristics of	if any problem arose.			
		participants	Intravenous antibiotic was			
		intervention vs. control	changed to oral therapy			
		/	(amoxicillin-			
		Age 77 (71–90) 79 (71–98)	clavulanate) after 4–6 days			
		Sex (female) 28 (82.4%) 16 (84.2%)	of treatment until complete			
		Cardiopathy 9 (26.5%) 6 (31.6%)	10 days of			
		Diabetes mellitus 4 (11.7%) 2 (10.5%)	treatment.			
		Chronic renal failure 4 (11.7%) 1				
		(5.2%)				
		Neoplasm 1 (2.9%) 1 (5.2%)				
		COPD 1 (2.9%) 1 (5.2%)				
		Corticosteroids 4 (11.7%) 2 (10.5%)				
		Previous diverticulitis 7 (20.5%) 3				
		(15.8%)				
		Abdominal pain 34 (100%) 19				
		(100%)				
		Fever 9 (26.5%) 6 (31.6%)				
		Diarrhea 6 (17.6%) 3 (15.8%)				
		Leucocytosis 7 (20.5%) 3 (15.8%)				
						201

Paq	e 61.0f 70	Study	Participants	Intervention	BMJ Open	Control	Outcomes assessed	Results
5	Year	Study	Participants	Intervention		Control	Outcomes assessed	Results
	Country							
	Leff	Prospective quasi	Inclusion criteria:	The study was conducted in 3	Outline of intervention	Outline of control	Relevant measures &	Intervention vs. control
1		experimental	Community-dwelling persons ≥65	Medicare managed care	&who delivered 1 Nov	1 Nov 1990-	outcomes	
2	[3066]		yrs old, Lived in catchment area	(Medicare +Choice) plans at 2 sites	2001-30 Sep 2002	30 Sep 2001) Eligible		Mean LoS (SD) days
3			In the opinion of a physician not	and at a Veterans	Patients evaluated	patients identified &	No distinction between	4.9 (9.9) 3.2 (2.5) p =0.004
4		2 consecutive 11 month	involved in study, required	Administration medical centre.	by HaH physician either in	followed through usual	primary and secondary	
	2005	phases	admission to an acute care	Univera Health and Independent	ED or after ambulance	hospital care.	outcomes	Mean time in ED (SD) in hrs
5	USA	Intervention:	hospital for these illnesses: community-acquired pneumonia,	Health, in Buffalo, New York, are Medicare + Choice plans These 2	transfer to home. HaH nurse met ambulance		Intervention group comprised all patients	6.4(1.8,11.6)SD 1.9 vs. 5.5(1.0,21.3) SD3.2
6	USA	Treatment in a hospital-at-	exacerbation of chronic heart	plans collaborated to provide	at patient's home and		eligible for hospital-at-home	P=0.001
7	Plus	home model of care	failure or chronic obstructive	hospital- at-home care and made	provided direct one-on-		care, irrespective of where	[Leff 2005]
8	Leff 2009	that substitutes for	pulmonary disease, or cellulitis.	up 1 study site (site 1).	one nursing for an initial		they were treated.	
9	[2545]	treatment in an acute care	Required to meet validated criteria		period of $\leq$ 8hrs at site 3		[thus some outcomes are	Changes in ADL and IADL from
	Frick 2009	hospital. Offered In the 2 <sup>nd</sup>	of medical eligibility for hospital-	The Fallon Health Care System (site	and ≤24 hrs at sites 1 &		NOT useful to us but some	1mth before admission -2
10	[0158]	phase of study	at-home care.	2), in Worcester, Massachusetts,	2. followed by		measures are HaH specific]	weeks after intervention
11		n=169	Exclusion criteria	operates a not-for-profit Medicare	intermittent nursing visits			ADL 0.39(3.13) vs0.6(3.09)
12		Control	Most common reasons for medical	+Choice plan, and the Fallon Clinic,	and HaH physician at		Mean LoS (SD) days [Leff	p=0.1
13		Control: Described as 'observation	ineligibility were uncorrectable hypoxemia, suspected myocardial	a for-profit multispecialty physician group, provides care on a capitated	least daily. HaH physician was available 24 hours a		2005]	IADL 0.74(2.86) vs0.70(2.68) p=0.007
		group' in the first phase of	ischemia, and presence of an acute	basis to Medicare + Choice	day for visits. Nursing and		Mean time in ED (SD) in hrs	[Leff 2009]
14		study. Eligible patients	illness, other than the target	beneficiaries.	other care components,			Costs
15		were identified and	illness, for which the patient was	serieitoistitesi	e.g. durable medical			Within each health system
16		followed through usual	required to be hospitalized.	The Portland, Oregon, Veterans	equipment, oxygen		Sub-analysis of HaH vs. Non-	and per condition Mean (SD)
17		hospital care.	Baseline characteristics of	Administration Medical Center (site	therapy were provided		HaH (i.e. different to main	Overall
		n=286	participants at all sites	<ol><li>is a quaternary care and teaching</li></ol>	and some services e.g.		report [Leff 2009]	\$5081(4427)vs.\$7480(8113)
18			(Stats shown if signif)	facility.	home radiology, support		Changes in ADL and IADL	p<0.001
19		Aim:	Observation vs. intervention Age		provided by independent		from 1mth before	Pneumonia
20		'to evaluate the safety, efficacy, clinical and	(SD) 77.3 (6.6) vs.77.2(7.0) % female 34 vs. 42%	A patient requiring admission to the acute care hospital for a target	contractors. Lifeline devices were provided for		admission -2 weeks after intervention	\$5272(6036) vs. \$6761(6451)
21		functional outcomes,	% white 90 vs.86%	illness was identified in an ED or	patients living alone.		mervention	NS
22		patient and caregiver	% in poverty 11 vs.19%	ambulatory site and his or her	Diagnostic tests ,		Costs	Congestive heart failure \$3310(2118) vs. \$6399(6643)
		satisfaction, and costs of	p=0.027	eligibility status was determined.	IV fluids, IV antimicrobial		Within each health system	p≤0.001
23		providing acute hospital	% live alone 43 vs.33%	Non-study medical personnel,	agents, etc. and		and per condition [Frick	COPD
24		level care in a hospital at	p=0.022	usually ED physicians, made the	oxygen/respiratory		2009]	\$4293(3806) vs. \$6500(7305)
25		home that substituted	Mean mini mental state (SD)25.5	decision to hospitalize the patient.	therapies were provided			p≤0.05
26		entirely for admission to	(4.2) vs. 25.2(4.4)	All patients who were offered but	at home.		Overall summary	Cellulitis
		an acute care hospital for	Mean Charlson score (SD)	who declined hospital-at-home	Patient was followed by		'The HaH care model is	\$4262(2309) vs. \$7287(11471)
27		older persons.' Setting:	3.1 (2.0) vs.3.0 (1.8) Mean medications (SD) 6.8 (3.9)	care were admitted to the acute care hospital.	same physician until discharged		feasible, safe, and efficacious for certain older	NS
28		Intervention (if received):	vs. 8.1(4.5) p=0.002	Study coordinators verified the	to primary care		patients with selected acute	[Frick 2009]
29		At home	%Primary admission diagnosis	patient's eligibility for HaH using a	printer, care		medical illnesses who	
30		Control	Pneumonia 31vs. 32%	standard protocol at enrolment.			require acute hospital-level	
31		Secondary hospital care	COPD 32 vs.28%	Most patients were identified the			care.' Leff 2005	
			Cellulitis 12 vs 18%	morning after admission.			HaH care is associated with	
32		Power calculation:	CHF 25vs.22%				modestly better	
33		No					improvements in IADL	
34							status and trends toward	
35							more improvement in ADL status than traditional acute	
							hospital care. Leff 2009	
36							Total costs seem to be	
37							lower when substitutive	
38							HaH care is available for	
39							patients with CHF or COPD	
40							disease.Frick2009	
40								

## Hospital in Nursing/Care Home (HNCH) (n=2)

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1	Author	Study	Participants	Intervention	Control	Outcomes assessed	Results
2	Year Country						
	Country	'quasi experimental'	Inclusion criteria:	In the ED. Enrolments were made	Outline of control	Relevant measures &	HINH vs. Control
3	2010	quasi experimental	Reside in an ACF.	by HINH programme manager	The comparison group	outcomes	Thinki VS. Control
4	Australia	[Controlled (his) study ]	Have a signed GP request for HINH	(registered nurse) with programme	was selected from	outcomes	Mean (SD)
5	Australia	[controlled (his) study]	review from the ACF.	director (ED director), GPs and ACF	patients who presented	Hospital LOS (days)	Hospital LOS
-			Be of any age (usually $\geq$ 65 yrs).	nursing staff, as appropriate. After	to ED and were	nospital 200 (adys)	2.19 (0.82) vs.6.2(0.59) days
6		Intervention:	Present with an illness that	hours and on weekends, if	subsequently admitted	ED LOS (hours)	p<0.001
7		Hospital in the nursing	required hospital services but not	patient was suitable for HINH , they	during the same time		
8		home (HINH) n=62	necessarily admission e.g. UTI &	stayed in ED short stay unit and	period. To be included in	Episode of care (total time)	ED LOS
9			could have treatment e.g.	were reviewed by HINH nurse on	this group, the patients	LOS (days)	9.94(0.66) vs. 7.01(0.47) hrs
		Control:	antibiotics continued by ACF staff.	next weekday.	had to reside in an ACF		p=0.005
10		Usual in-hospital care	Prior to start of HINH, patients		and be aged ≥65yrs. ACF	Long (≥6days) vs. short	
11		n=115	who would have fit inclusion	Outline of intervention	residents who presented	hospital LOS	Episode of Care LOS
12			criteria for hospital admission	The HINH nurse checks with the	to the ED were in some		9.56(1.26)vs. 6.20(0.59) days
			Exclusion criteria:	ACF registered nurse and patient on	cases not enrolled in	Long (≥8 days) ED LOS vs.	p=0.14
13			ACF residents who required	the patients' progress initially on a	HINH because they	short	
14			extensive treatment that could not	daily basis and then every couple of	had a medical problem		Percentages
15			be managed in ACF or who	days. Discharge occurs when	that was judged as	Long episode of care (≥6	Hospital LOS 6+days
			required specific services that	required treatment has ceased. This	possibly requiring in-	days)	9.6 vs. 40 p<0.001
16			could only be received in hospital	completes the patients' hospital-	hospital admission		Episode of care 6+days
17			e.g. surgery	affiliated episode.	services beyond those	Hospital readmissions	46.8 vs.40.0 p=0.35
18			Baseline characteristics of		offered by the HINH.	within 28 days	LOS in ED 8+ hours
			participants	Intervention delivered by:	HINH.		50.0vs.33.9 p=0.05
19			HINH vs. Control	HINH programme delivers acute	Intervention delivered	Costs	Readmission in 28 days
20			Age (SD) 85(7.1) vs.84.6(6.6)years	care nursing support services,	by:	None	11.3 vs. 11.3 p=0.99
21			Triage category	medication and equipment to the	No details but	None	11.5 V3. 11.5 p=0.55
22			3.2 (0.7) vs.3.2(0.7)	ACF registered nurse and/or	presumably usual		
			Female 76vs. 75%	enrolled nurse. These services may	hospital staff		
23			Diagnostic category: Respiratory	include	noopital stall		
24			24 vs.26%	initial training and education			
25			Cellulitis 18 vs.17%	regarding antibiotic or IV fluid			
			Kidney/urinary tract 18vs.16%	administration; specific wound		<sup>2</sup> h	
26			Cardiac 10 vs. 10 %	treatment and dressing procedure			
27			Abdominal/GI 8vs.8%	(with dressing materials);			
28			Viral/sepsis 7 vs.6%	suprapubic catheter care,			
			All other 16 vs.17%	behaviour management and			
29				palliative care.			
30							
31							
32							
33							
34							

Australia         Intervention reatment in regionalization media         attenti media         attenti me	Page	e 63.0f 70	Study	Participants	Intervention	<sub>co</sub> ස്MJ Open	Outcomes assessed	Results
Lu         Control (relation contention)         Inclusion contention         Inclusion contention         Inclusion contention         Inclusion contention         Patter and profession           2         2033         Australia         Inclusion contention         Content control         Australia         Inclusion contention         Patter control         Patter								
1         2013         series         Protect and/or family consent. Inserved to a started         Add care unit (ACU)         A			Controlled (his) Case	Inclusion criteria:	In the ED the acuity of procenting	Outling of control	Polovant moasuros 8	
2     2013     2013     Capacity within HTT is accept the accept the protein in backet manage the care introduces (FK) protein in backet management for the protein in the steering (FGC) in the steering (FG	1	Lau						
3         Autralia         Intervention Treatment In resident Lager Care         patient Fielding value         patient Fielding value         Patient Fielding value         Montality of Alcharge Value	2	2013	Series			ABed care and (Aeo)	outcomes	34 (35.8%) 13 (7.8%) <0.001
4       Autornalia       In relationship for each of the pattern in the patte			Intervention Treatment			Inpatients treated in ACU	Palliative care	. , . ,
5     med8     med8     med8     med1     med1 <t< td=""><td></td><td>Australia</td><td>in residential care</td><td>Facility able to manage the care</td><td>who presented after hours were</td><td>in preceding year July-</td><td></td><td>11 (11.6%) 20 (12.0%)</td></t<>		Australia	in residential care	Facility able to manage the care	who presented after hours were	in preceding year July-		11 (11.6%) 20 (12.0%)
6 7 8 9 9 9 10 10 10 10 10 10 10 10 10 10 10 10 10			facilities (TRC) grp				Mortality on discharge	
0     Control     Educision criteria:     patient:     magents: who have been admitted form calculation     many formation       10     Behavioual distribution (C), who particle is particle is particle is particle is particle is core unit (ACU) n=10;     Educision criteria:     The distribution (C), who particle is particle is particle is particle is core unit (ACU) n=10;     Behavioual distribution (C), who particle is particle is particle is core unit (ACU) n=10;     Behavioual distribution (C), who particle is particle is particle is core unit (ACU) n=10;     Behavioual distribution (C), who particle is particle is particle is core unit (ACU) n=10;     Behavioual distribution (C), who particle is particle is core unit (ACU) n=10;     Behavioual distribution (C), who particle is particle is distribution (C) and particle	5		n=95	- · · ·				-
7       Hospital-based aged care unit (ACU) Pe157       Exclusion criteria: the geriatrician & team members with address in the constant fragment and/or family.       The geriatrician & team members with address in the constant fragment and/or family.       month       Re-bospitalization within 1- month       Re-bospitalization and/or maily.         10       Intervention delivery of care e.g. gress with balance discussion were carried out in the RAC.       The geriatrician & team members with address in the gress with balance discussion were carried out in the RAC.       Intervention delivery transit but month       Intervention delivery month       Intervention delivery month       Intervention delivery month       Intervention delivery month       Intervention delivery month         10       Intervention delivery month       The delivery of care e.g. gress with balance discussion were carried out in ACU.       Appropriate Link delivery (DCPI) sequent were used of the sequent discussion were carried out in ACU.       Appropriate Link delivery (DCPI) sequent were used of the following: transit delivery (DCPI) sequent were used of the following: transit were used of the following: transit were used of the following: transit were used to the following: transit were used to the following: transit we used the following: transit were used to the following: transit were used to the following: transit were used to the following: transit we used to the following: transit we used the following: transit were used to the following: transit with access to allied health t	6		Control	(RACF)			6-month mortality	
8     care unit (ACU) m-167     Lack of concent from patient method or family.     would use clinical judgement to derice.     method is clinical judgement to management of general method conditions.     month     month     20 (21.33) 3 (21.08) pcf incide / obspitalization at months       11     14 <td>7</td> <td></td> <td></td> <td>Exclusion critoria:</td> <td></td> <td></td> <td>Pehospitalisation within 1-</td> <td></td>	7			Exclusion critoria:			Pehospitalisation within 1-	
9     and/or family.     determine if a patient was suitable management of general management of general medical constitution.     Total hospitalisation et 6 maths     20 (21.393 35 (21.096) pcf maths       10     Behavioural distructions; which may prevent the delivery of care Hitter or of recerr tails, which may appresent the delivery of care Hitter or of recerr tails, which may appeared to the Elder (RECEP)     Intervention Program into the Elder (RECEP)     Intervention delivered by trappeared by usual hospital staff     Imagement of general maths     20 (21.393 35 (21.096) pcf maths       14     Hitter was conflict regarding management, further input and discussion were carried out in ACU.     Appropriate Clinical Diagnosis Delydration, Pherumenia, Urinary Deep Venous Thrombols, Terminal Deep Venous Thrombols, Terminal Hitter was conflict regarding maths     Costs     None       10     Baseline characteristics of participants     Tratament can therefore include appropriate Allereta in thereared propriate Allereta Deep Venous Thrombols, Terminal Hitter with the following participants     Tratament can therefore include appropriate Allereta Deep Venous Thrombols, Terminal Hitter with the following Participants     Tratament can therefore include appropriate Allereta Deep Venous Thrombols, Terminal Hitter with the following Participants     Tratament can therefore include appropriate Alleret theration appropriate Allereta Depropriate Allereta Deproprise Allereta Depropriate Allere					÷		•	-
9     Behaviouri disturbances, which map prevent the delayry of care e.g. aggressive behaviour and frequent removal OV knocess device.     for TRC     medical conditions.     Total populations of s months     Total populations of s months     Total Appellations     Total Appellatio							month	20 (21.1%) 35 (21.0%) p=0.986
11     c.s. aggressive behaviour and requert removal of Naccess device.     Outline of Intervention intervention device.     Intervention by: r: No details but program into the Elder(NEQ) ellevered by: the No details but hospital staff     Length of Sopiel acrossive intervention hospital staff     39 (41.378) 68 (0.77.9) el- Length of Sopiel acrossive required to strong of the space of the delivery of care in the RACF.     All measured as 'present on not'     All measured as 'present on no							Total hospitalisation at 6	Total re-hospitalization at 6
12Image: constraint of the sector	10			may prevent the delivery of care			months	months
12     Infraguent termoval of W, access device.     Treatment in Residential Care Intervention the RACF.     Declasibut termine in Residential Care Intervention the RACF.     Declasibut termine in Residential Care Intervention the RACF.     Declasibut termine in Residential Care Intervention declassion were carried out in ACD.     Declassion were	11							39 (41.1%) 68 (40.7%) p=0.963
13     History of recent falls, which may program into the Eddery (BC(PE)) the RAC 7.     Presumably usual program into the Eddery (BC(PE)) service between July-Oct 2008.     All measured as 'present or not'     all measured as 'present or not'     approvint of production of							Length of hospital care/stay	
14     impact on the delivery of care in the RACF.     Program into the Elder (RECPE) is service Delivery 042008.     hospital staff     not'     Pec0.01       15     if there was conflict regarding management, further input and discussion were carried out in ACU.     Appropriate Clinical Diagnosis     Costs     None       18     ACU.     Tract Infection, Gastroenter/itis, Deep Venous Thrombosis, Terminal care support.     None     None       21     TRC vs. ACU     Treatment can therefore include any of the following: UN antibuotes & Whulds     None     None       22     Reg 83.5 vs.82.pr/s     Anticoguitation     Oxygen therapy (low flow) Appropriate Allied Health intervention     None     None       23     None.finglish speaking 42 vs. 48%     Oxygen therapy (low flow) Appropriate Allied thealth intervention     None     None       24     TRC vs. ACU     None.finglish speaking 42 vs. 48%     Appropriate Allied thealth intervention     None     None       26     Panentia 77.9w.5.5.5% pc.0001     Charlson score 53 upport are appropriate support programs     None     None     None       28     71.15 0 1.9 vs. 7.2 SD 2.3     * (TRC also offered pallative care as appropriate. If patient's condition charged and management, cuid not be condition charged into management, cuid not sponse despite optimal treatment.3     None     None							All managered on involgent	
14     the RACF.     service between July-Oct 2008.     Equivalent of 270 vs. 184       16     management, further input and discussion were carried out in ACU.     Approviate Clinical Diagnosis Dehydration, Pearumonia, Julinary Tract Infection, Gastroenteritis, Deep Venous Thrombosis, Terminal care support.     Costs None       19     Baseline characteristis of participants     Treatment can therefore include any of the followis, Terminal care support.     Costs None       21     TRC vs. ACU participants     Treatment can therefore include any of the followis, Terminal care support.     None       23     Non-English speaking 42 vs. 48%     Treatment can therefore include any of the followis R.     None       24     Age 33 vs. 52 yr 42 vs. 76%     Treatment can therefore include any of the rappropriate support programs     Appropriate Allied Health intervention       29     7.1 SD 1.9 vs. 7.2 SD 2.3     "TRC also offered pallayers care as appropriate. If patient's condition changed and management. Ut patient's condition changed and acute hospital was organice. If patients had uncertain programs     Image and the support' reatment was preve, followed by pallative care if no response despite optimal reatment.]       36     Image and the support in the response despite optimal reatment.]     Image and the support in the support, in t								-
15       If there was conflict regarding management, further input and discussion were carried out in ACU.       Appropriate Clinical Diagnosis Dehydration, Preumonsis, Urinary Tract Infection, Gastraemteritis, Deep Venous Thrombosis, Terminal care support.       Costs       None         19       Baseline characteristics of participants       Treatment can therefore include any of the following: Numerity for the followi						nospital stall	101	
16     management, further input and diccussion were carried out in AQU.     Appropriate Clinical leganosis Dehydraton, Perumonia, Urinary Tract infection, Gastronelentis, Deep Venous Thrombosis, Terminal care support.     None       19     Baseline characteristics of participants     Treatment can therefore include any of the following: Treatment can therefore include any of the following: Vanticaguitation     None       21     TRC vs. ACU participants     Treatment can therefore include any of the following: Vanticaguitation     None       22     Age 33. vs. 28, 8/rs Female 53. vs. 29, 8/rs Von-Fngiths peeking 42. vs. 48%     None     None       23     Non-Fngiths peeking 42. vs. 48%     Appropriate Allied Health intervention     None       24     Dementia 73. vs. 45.5% pc.0.001 Charlson score 72. vs. 76%     Dementia 71. vs. 45.5% pc.0.001 Charlson score 72. vs. 76%     Pallative support registrate Allied Health intervention     None       29     7.1 Sp 1.9 vs. 7.2 Sp 2.3     "TRC cas offered pallative care as appropriate	15				Schuce Setween July Oct 2000.			
17     discussion were carried out in ACU.     Dehydration, Preumoina, Uninary Tract Infection, Gastroenteritis, Deep Venous Thrombods, Terminal Care support.     None       19     Baseline characteristics of participants     Tract Infection, Gastroenteritis, Care support.     None       21     TRC vs. ACU     ary of the following:     None       22     TRC vs. ACU     ary of the following:     None       23     Tract vs. ACU.     ary of the following:     None       24     Age 83.5 vs.82.8/rs     IV antibiotics & IV Muids     None       25     Oxygen therapy (low flow)     Oxygen therapy (low flow)     None       26     Penaletis 53 vs.55%     Oxygen therapy (low flow)     None       27     Charlon score     72 vs.76%     State of the appropriate support*       28     Tract vs.76%     State of the appropriate support*       29     Tract score     Tract vs.76%       30     Charlon score     Tract of the appropriate support*       31     Charlon score     Tract vs.76%       32     State of the appropriate of the appropriate support*     Paliative care in a response       33     State of the appropriate support*     Paliative care in a response       34     State of the appropriate support     State of the appropriate support       33     State of the appropriate support	16			• •	Appropriate Clinical Diagnosis		Costs	
18       A.C.       Pact infection, subtrantions, terminal care support.         19       Baseline characteristics of participants       Treatment can therefore include any of the following:         20       ITRC vs. ACU       any of the following:         21       IRC vs. ACU       any of the following:         22       Age 83.5 vs.82.8 vrs.       IV antibiotics & IV fluids         23       Pember 30.5 vs.90%       Anticoagulation         24       42.vs.48%       Appropriate Allied Health         25       Intervention       Intervention         26       Dementia 77.9vs.45.5% pc0.001       Referral to other appropriate         27       Charlson score       support programs         28       7.1 SD 1.9 vs. 7.2 SD 2.3       "ITRC also offered pallative care as appropriate. If patient's condition changerine into acute hospital was organized. If patient's condition changerine into acute hospital was organized. If patients had uncertain prognosis, treatment was given, followed by pallative care if no response despite organized and massignent followed by pallative care if no response despite organized. If patients had uncertain prognosis, treatment was given, followed by pallative care if no response despite organized. If patients had uncertain prognosis, treatment was given, followed by pallative care if no response despite organized. If patients had uncertain prognosis, treatment was given, followed by pallative care if no response despite organized. If patients had uncertain prognosis, treatment was given, followed by gallative care if				discussion were carried out in	Dehydration, Pneumonia, Urinary		None	
19     Baseline characteristics of participants     care support.       21     TRC vs. ACU     any of the following: any of the following:       22     Age 33.5 vs.82.8yrs     IV athibitics & IV fluids       23     Age 33.5 vs.82.8yrs     V athibitics & W fluids       24     Age 33.5 vs.82.8yrs     Anticoagulation       25     Female 53 vs.59%     Anticoagulation       26     Dementia 77.8yr.45.5% pc.0.001     Dementia 77.8yr.45.5% pc.0.001       27     Dementia 77.8yr.45.5% pc.0.001     Palliative support *       28     7.1 SD 1.9 vs. 7.2 SD 2.3     * [TRC also offered palliative care as apporpriate support programs       30     as porportize fluid was organized. If patient's condition changed and management could not be continued, transfer into acute hospital was organized. If patient's defined the attribution acute hospital was organized. If patient's defined to avail was given, followed by palliative care designe optimal treatment.]       31     Image method for a support of the consoling defined the t				ACU.	Tract Infection, Gastroenteritis,			
20       participants       Treatment can therefore include any of the following:         21       TRC vs. ACU       any of the following:         22       Age 33.5 vs.52%       IV antibiotics & IV fluids         23       Non-English speaking       Oxygen therapy (low flow)         24       4.8%       Appropriate Alied Health         High level of nursing homecare       Palliative support*         26       Dementia 77.9vs.45.5% pc0.001         27       Charlson score         28       7.1 SD 1.9 vs. 7.2 SD 2.3         * [TRC also offered palliative care         30       a sappropriate. If patient's conflict was given, followed by palliative support, treatment was given, followed by palliative support, treatment was given, followed by palliative support, treatment was given, followed by palliative care into acute hosptalt was organized. If patient's conflict on the acute hosptalt was organized. If patient's conflict on the appropriate. If patient's conflict on the dupert in prognoms, treatment.]         33       Intervention delivered by: despite optimal treatment.]         36       Geriatrician, registrar and nursing staff with access to allied health staff such as physiotherapy, OT, speech pathology and social work.         39       Intervention delivered by: speech pathology and social work.								
35     despite optimal treatment.]       36     Intervention delivered by:       37     Geriatrician, registrar and nursing       38     staff with access to allied health       39     staff such as physiotherapy, 0T,       40     speech pathology and social work.	19				care support.			
35     despite optimal treatment.]       36     Intervention delivered by:       37     Geriatrician, registrar and nursing       38     staff with access to allied health       39     staff such as physiotherapy, 0T,       40     speech pathology and social work.	20			participants	Treatment can therefore include			
35     despite optimal treatment.]       36     Intervention delivered by:       37     Geriatrician, registrar and nursing       38     staff with access to allied health       39     staff such as physiotherapy, OT,       40     speech pathology and social work.				TRC vs. ACU	any of the following:			
35     despite optimal treatment.]       36     Intervention delivered by:       37     Geriatrician, registrar and nursing       38     staff with access to allied health       39     staff such as physiotherapy, 0T,       40     speech pathology and social work.					IV antibiotics & IV fluids			
35     despite optimal treatment.]       36     Intervention delivered by:       37     Geriatrician, registrar and nursing       38     staff with access to allied health       39     speech pathology and social work.					Anticoagulation			
35     despite optimal treatment.]       36     Intervention delivered by:       37     Geriatrician, registrar and nursing       38     staff with access to allied health       39     speech pathology and social work.				Non-English speaking	Oxygen therapy (low flow)			
35     despite optimal treatment.]       36     Intervention delivered by:       37     Geriatrician, registrar and nursing       38     staff with access to allied health       39     speech pathology and social work.	24				Appropriate Allied Health			
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35     despite optimal treatment.]       36     Intervention delivered by:       37     Geriatrician, registrar and nursing       38     staff with access to allied health       39     speech pathology and social work.					Palliative support*			
35     despite optimal treatment.]       36     Intervention delivered by:       37     Geriatrician, registrar and nursing       38     staff with access to allied health       39     speech pathology and social work.					support programs			
35     despite optimal treatment.]       36     Intervention delivered by:       37     Geriatrician, registrar and nursing       38     staff with access to allied health       39     speech pathology and social work.					support programs			
35     despite optimal treatment.]       36     Intervention delivered by:       37     Geriatrician, registrar and nursing       38     staff with access to allied health       39     speech pathology and social work.					* [TRC also offered palliative care			
35     despite optimal treatment.]       36     Intervention delivered by:       37     Geriatrician, registrar and nursing       38     staff with access to allied health       39     speech pathology and social work.	29				as appropriate. If patient's			
35     despite optimal treatment.]       36     Intervention delivered by:       37     Geriatrician, registrar and nursing       38     staff with access to allied health       39     speech pathology and social work.	30				condition changed and			
35     despite optimal treatment.]       36     Intervention delivered by:       37     Geriatrician, registrar and nursing       38     staff with access to allied health       39     speech pathology and social work.					management could not be			
35     despite optimal treatment.]       36     Intervention delivered by:       37     Geriatrician, registrar and nursing       38     staff with access to allied health       39     staff such as physiotherapy, OT,       40     speech pathology and social work.					continued, transfer into			
35     despite optimal treatment.]       36     Intervention delivered by:       37     Geriatrician, registrar and nursing       38     staff with access to allied health       39     speech pathology and social work.					acute nospital was organized. If			
35     despite optimal treatment.]       36     Intervention delivered by:       37     Geriatrician, registrar and nursing       38     staff with access to allied health       39     speech pathology and social work.					treatment was given followed by			
35     despite optimal treatment.]       36     Intervention delivered by:       37     Geriatrician, registrar and nursing       38     staff with access to allied health       39     speech pathology and social work.	34				palliative care if no response			
36       Intervention delivered by:       Geriatrician, registrar and nursing         37       Geriatrician, registrar and nursing         38       staff with access to allied health         39       staff such as physiotherapy, OT,         40       speech pathology and social work.	35							
37     Geriatrician, registra and nursing       38     staff with access to allied health       39     staff such as physiotherapy, OT,       40     speech pathology and social work.								
38     staff with access to allied health       39     staff such as physiotherapy, OT,       40     speech pathology and social work.					-			
39   staff such as physiotherapy, OT,     40   speech pathology and social work.								
39   speech pathology and social work.     40								
40	39							
					speech pathology and social work.	I		l
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#### **PROSPERO International prospective register of systematic reviews**

## A systematic review to identify and assess the effectiveness of hospital alternatives for people over the age of 65 who are at risk of potentially avoidable hospital admission

Alyson Huntley, Melanie Chalder, Will Hollingworth, Chris Metcalfe, Ben Davies, Sarah Purdy

#### Citation

Alyson Huntley, Melanie Chalder, Will Hollingworth, Chris Metcalfe, Ben Davies, Sarah Purdy. A systematic review to identify and assess the effectiveness of hospital alternatives for people over the age of 65 who are at risk of potentially avoidable hospital admission. PROSPERO 2015:CRD42015020371 Available from http://www.crd.york.ac.uk/PROSPERO\_REBRANDING/display\_record.asp?ID=CRD42015020371

#### **Review question(s)**

1) What admission alternatives are there for older patients and do they improve patient outcomes e.g. mortality, quality of life?

2) What are the defining characteristics of those older patients for whom the decision to admit to hospital may be unclear?

#### Searches

MEDLINE, MEDLINE in process, EMBASE, CINAHL and the Cochrane Central Register of Controlled Trials (CENTRAL) from 2005 to April 24th 2015. The Kings Fund and AHRQ websites were also searched

#### Types of study to be included

Any type of controlled study

#### Condition or domain being studied

Any condition that may result in an avoidable hospital admission in patients over the age of 65.

#### Participants/ population

People over 65 years of age of either sex living in OECD countries who are at risk of an unplanned admission (probably for an ambulatory sensitive condition) - they will therefore not be admitted to hospital at time of recruitment but could be in community or emergency department (being assessed).

#### Intervention(s), exposure(s)

The intervention of interest is admission to hospital, using definitions developed for previous studies (Huntley et al, Family Practice Fam Pract. 2013 Jun;30(3):266-75.). However it is important to point out that admission is likely to be the control group in many relevant studies.

#### Comparator(s)/ control

Alternatives to admission (likely to be described as the intervention) including but not limited to: hospital at home, virtual ward, rapid response nursing, care at home, admission to a care home, usual care.

#### Context

Reducing emergency bed days is one of the biggest challenges currently facing the National Health Service (NHS). There is considerable pressure to reduce hospital admissions amongst older people (D'Souza, BMJ 2013). There has been a 65% increase in hospital admissions for those over 75 years of age in the last decade ,and the oldest old, those over 85 years , now account for 11% of emergency admissions and 25% of bed days (NHS England 2013). There are some older people for whom care in the community is safe,perhaps with the provision of additional services and some for whom admission is required in order to deliver diagnostic or treatment techniques that are only available as an in patient. This review seeks to identify interventions for those patients that do not fall neatly into one of these categories and in doing so will assess the efficacy of the interventions and provide more detail on this patient

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population.

#### **Outcome**(s)

**Primary outcomes** 

1) Patient outcomes (including mortality, quality of life, length of stay, readmission, adverse effects of intervention) plus costs if available.

2) Patient characteristics for whom their pathway (admission or not) is unclear including risk factors e.g. comorbidities (mental & physical), age, gender, social circumstances ,disease severity, recent admission/discharge availability of other services

Secondary outcomes

None

#### Data extraction, (selection and coding)

Standardised data extraction forms will be developed using existing guidelines (Higgins 2008 Cochrane handbook chapter 7 section 7.5). Data will be abstracted by one reviewer. A second reviewer will check data abstraction against the original paper. Data items: details on participants, Interventions, comparisons, outcome measures

#### Risk of bias (quality) assessment

Cochrane risk of bias tool will be used for randomised controlled trials. CASP criteria will be used for controlled trials

#### Strategy for data synthesis

Meta-analysis of data will be performed using Review Manager Version 5.1 if there are at least three trials with combinable data with a fixed or random effects model depending on the level of between trial heterogeneity estimated using the I-squared statistic. Sensitivity analysis will be performed as the data dictates.

#### Analysis of subgroups or subsets

Dependent on data found

#### **Dissemination plans**

This review is part of programme development grant.

#### **Contact details for further information**

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#### **Review team**

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# UNIVERSITY of York Centre for Reviews and Dissemination

Page 66 of 70 National Institute for Health Research

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## Details of any existing review of the same topic by the same authors

None

Anticipated or actual start date 02 February 2015

#### Anticipated completion date

29 January 2016

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#### **Conflicts of interest**

None known

## Language

English

#### Country

England

#### Subject index terms status

Subject indexing assigned by CRD

#### Subject index terms

Hospitalization; Hospitals; Humans

#### Stage of review

Ongoing

#### **Date of registration in PROSPERO** 14 May 2015

## Date of publication of this revision

14 May 2015

#### DOI

10.15124/CRD42015020371

Stage of review at time of this submission	Started	Completed
Preliminary searches	No	Yes
Piloting of the study selection process	No	Yes
Formal screening of search results against eligibility criteria	Yes	No

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National Institute for Health Research

Data extraction	No	No
Risk of bias (quality) assessment	No	No
Data analysis	No	No

#### **PROSPERO**

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## PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Page 1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	Pages 2-3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	Page 5
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	Pages 5-6
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	Page 6
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	Page 6
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	Page 6
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Appendix 1
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	Pages 6-7
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	Page 7
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	Page 7
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	Page 7
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	N/A
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., $I^2$ ) for each meta-analysis.	Page 8



## **PRISMA 2009 Checklist**

3 4 5 Section/topic	#	Checklist item	Reported on page #		
6 7 Risk of bias across 8 studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	Page 7		
9 Additional analyses 10	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	n/a		
2 RESULTS					
13 Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	Page 8 and Figure 1		
6 Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Pages 8-17		
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	Pages 8-17 and Appendices 2 & 3		
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	Pages 8-17 and Appendix 5		
23 Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	Pages 8-17 plus narrative presentation		
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	Pages 8-17		
28 Additional analysis 29	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	n/a		
32 Summary of evidence	ry of evidence 24 Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).		Page 18		
34 35 36	25 Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).		Pages 18-19		
7 Conclusions 38	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	Page 19		
FUNDING					
41 Funding 42	ding       27       Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.		Page 21		

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